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Arts and Artisans at Home and Abroad: with sketches of the progress of Foreign manufactures. By JELINGER C. SYMONS, Esq., *one of the assistant Commissioners on the hand-loom inquiry, &c.*

[CONTINUED FROM PAGE 317.]

Wages in France and Physical condition of the Artisans.

Monsieur Dupin has stated 2 fr. 26 cent. per day as the average payment in the northern, and 1 fr. 90 cent. as the average in the southern provinces. I believe this to be perfectly correct. There are numbers of trades wherein 1 fr. 50 cent. is the average rate of wages per day, but a far greater number earn 2 fr., which, taking France through, I believe to be as near an estimate as can be formed. They who subsist entirely on the profits of weaving plain goods, fall below 1 fr. 25 cent. or 1*s.* per day net wages, but these form a small and insignificant fraction of the working adults of the country.

I will give the rates of wages in the chief departments of manufacturing labour *seriatim* as I visited the districts. Alsace is the chief cotton district.

In Messrs. Schlumberguer's and Bocard's mills at Guebwillers, the wages were stated to me to be—

Spinners,	2 to 3 fr. per day.
Women,	1 fr. 50 cent. to 2 fr. per day.
Girls,	1 fr. per day.
Slubbers,	1 fr. 40 cent. to 1 fr. 50 cent. per day.

In the "Rapport," however, given in by these gentlemen in the year 1829, to a government commission of inquiry in France, I find the following different return:—

Men,	1 fr. 40 cent. to 2 fr.
Women,	1 fr. to 1 fr. 20 cent.
Children,	40 cent. to 70 cent.

The increased aptitude of the workmen since 1829, may in some degree account for this discrepancy; but from other inquiries, I am convinced the former of these statements is the maximum, rather than the average rate of payment.

The hours of labour always exceed 13, and are often 14 of actual work, children as well as adults. There is no factory regulation law in France.

The wages of the hand-loom weavers are on the whole, the cost of living being taken into account, higher than in Scotland. In Normandy and in some few places in Alsace they are as low; everywhere else they are higher, or to speak more correctly, everywhere else have the hand-loom weavers of France a greater amount of the necessaries and comforts of life.

I have shown that the reverse is the case with all other employments.

It is unnecessary to detail the wages of the hand-loom weavers, which vary for the most skilled class from 6 to 9 fr. per week; for the second rate class from 4 fr. 50 cent. to 6 fr.; and for women and children, forming the third or lowest class, from 2 fr. to 4 fr. 50 cent. These are net wages; the manufacturers either beaming the warps and furnishing the looms in factories, or paying equivalently. Something more, however, is generally earned in the factories; for the weavers prefer usually working at their own homes. The average net wages of an adult Alsace weaver will not exceed 5 francs; that is, a piece of calico of 70 porters, (French) 28 shots in a quarter of an inch, is paid about 5 fr. the cut of 25 French ells (of 44 inches); a good weaver will perhaps weave five ells per day, including lost time, or 6 francs gross wages.

The homes of the working classes are, for the most part, dirty, comfortless, and evincing every symptom of bad management and poverty combined. Even those who have children in the cotton mills, do not keep up any appearance of comfort. I am aware that, passing immediately from Switzerland, where the cottages are pictures of neatness and comfort, I was apt to be too unfavourably impressed with the very inferior condition of the Alsacian artisans. I shall, however, corroborate my own view of the matter, by a quotation from the opinion of one eminently qualified to form a judgment of the mental as well as bodily condition of those around him. In the mean time, I may remark, that I believe that the Alsacian weavers are, generally speaking, not without a sufficiency of food, though in all other respects they are certainly ill off. In the mountains of the Vosges, the peasantry are worse off still, and there looms are also found, but chiefly on the system of the "customer" weavers of Scotland, though not exclusively, for there are some who weave for manufacturers at very low wages.

On this subject, Mr. Nicholas Schlumberguer of Guebwiller, an eminent manufacturer, thus writes to me:—

"On the question which is engaging your attention, it may be said in general, that upon the whole the working class can live much more cheaply in France than in England, and consequently the rate of wages is lower in our country than in yours. It may also be said that the working classes are less given to the vice of drunkenness in France than in England; but they

are not moral for all that; their want of prudence is excessive; they live from hand to mouth (du jour le jour); the least illness, or want of work at all prolonged, plunges them into a state of profound misery. They feed themselves irregularly; their houses are dirty, which contributes to render their physical state worse than that of the English workmen.

"The moral and physical condition of the working class in general remains nearly stationary; there are made, here and there, efforts for its amelioration which have had happy results, but, up to this time, the opposition of the great majority of the manufacturers has prevented the Government from proposing to the chambers any regulations analogous to those which exist in England, on the age of admission of children in the factories, and in the duration of work."

At Lyons the long stagnation incidental to the American crisis, caused, since Dr. Bowring's visit, considerable distress; from the effects of which, the recent development of trade has but just relieved them. Neither have all the departments of Lyonese weaving yet resumed their former rates of wages. In the plain goods (articles unis,) in which Zürich is very successfully competing with France, little is now done at all in Lyons. This description of goods has been carried (since Dr. Bowring's visit in 1834) almost entirely into the country, where, of course, food and lodging are to be had at much lower prices, and where, as the workmen are more scattered and less able to concert measures for keeping wages up, wages are more easily lowered. The necessity for lowering them, however, was apparent to me whilst at Zürich; and I was as much convinced by what I saw there, that Lyonese wages in plain silks must fall, as if I had already ascertained the fact.

The conflict which formerly existed between the *chefs d' attelier* (who are the owners of the workshops, containing from one to ten looms,) and their journeymen called *compagnons*, goes on in the country just as much as it formerly did in Lyons. In the town much greater harmony subsists as wages have for the most part risen. It is usual for the chef d' attelier to share the wages paid with the weaver or compagnon who weaves the web, the former supplying lodging and upholding the loom and defraying every contingent expense.

The following are examples of the changes in the rate of payment by the fabricant:—

	1834.		1838.	
	fr.	cent.	fr.	cent.
Common plain velvets, (per ell)	3	50	5	50
Light plain satins,		60		70
Gros de Naples, fine quality, plain,		70		90
Do. light do.		50		60
Common figured silks,		80	1	00
Rich do. do.	1	00	1	50

There are among the figured silks for waistcoats, articles paid for as high as 5 and 6 fr. the ell. There is a new description of shawls, of which the ground is thick satin with velvet flowers, having the appearance of being embossed on it, of singular beauty and elaborate design, for which as much as 12 fr. per day gross wages are paid to the chef d' atteliers.

If a chef gained 2 fr. clear per day in 1834, he will gain at least 2 fr. 50 cent. now, and the compagnon must be an idle follow if he earns less than 1 fr. 75 cent. Many earn upwards of 2 fr. per day.

It appeared also that a great moral improvement had taken place in Lyons, in consequence of the removal of some of the lower paid weavers to the country.

The independence of the weavers of Lyons is very great, and this is caused by the character of the industrial system pursued. The fabricant, of whom there are between 500 and 600 in Lyons, merely gives out the pattern and silk to the chef d' attelier, to whom is intrusted the entire task of producing the web through all the manifold difficulties of the complex operations incidental to the manufacture. The money paid is the object of separate barter, and is generally fixed at joint meetings of weavers and the fabricans. Continual disputes used to occur between them, which are now for the most part transferred to the chef d' atteliers and their compagnons, the latter having become extremely exorbitant in their demands. These form the least respectable class of weavers in Lyons. Having no fixed home they are a fluctuating population, and have neither the stability nor the activity of those who are intrusted with the responsibility, and to whom it imparts respectability. They sometimes, however, amass considerable savings, and occasionally, though not often, establish themselves as chef d' attelier.

In addition to the compagnons, or journeymen, there are also apprentices of both sexes to whom the master teaches his trade, either for a sum of money, or a period, during which the profits of the apprentice's labour belong to the master. When they are sufficiently practised in their art, the master gives the apprentices a task to perform, and whatever they do above is their own profit. If they fail in doing it, an indemnity is recoverable by the master.

With the high wages gained by the weavers, they are of course enabled to live well, and spend no inconsiderable sum on the aggregate in their Monday and Sunday recreations. The usual meals, and their cost, of a compagnon or common weaver, are thus accurately stated by Dr. Bowring: —"1½ lb. of bread, 30 cent., or 3*d.* (the pound being 18 ounces, and the best bread); one-fourth litre of wine, 12½ cent.; dinner, 25 cent.; cheese, 10 cent.; supper, 10 centimes." The dinner will consist generally of soup, and often of a bit of meat in it. Rent varies from L.3 to L.5 per annum, for two or three rooms. Many of the compagnons are boarded by their employers at about 5d. per day. Hours of work vary from 12 to 15.

In appearance, the weavers are an emaciated, miserable-looking set of beings. They are diseased and undersized. The parts of the dirty town of Lyons in which the weavers are principally located, are close and filthy, especially those lying between the Saone and the Mountains de St. Just and de Fourvières. Many individuals are often crowded together in a small apartment, one room frequently containing the man and his wife, two or three children, and a workman and his wife.

Lyons, however, is peculiarly exempt from epidemic disease, and was wholly free from cholera, though exactly in the line it took in 1832, and built, moreover, on the banks of two large rivers. I am persuaded that it owes this entirely to the large lime-kilns in the suburbs; the exhalation of which perceptibly impregnates the atmosphere; and I believe this to be a perfect preventive of cholera.

Tarare, near Lyons, is the chief muslin district of France, and the following extract from a letter, from an intelligent manufacturer, conveys the chief information I collected.

"A portion of our weavers in the country, gain only 75 cent. (7½*d.*) to 1 fr. 25 cent. (1*s.*) per day; those of the town, from 2 fr. to 2 fr. 50 cent.,

and sometimes 3 fr. according to their skill. The manufacturer furnishes only the reed and the upper mounting, all the rest being at the expense of the workmen. No deduction is made from the wages for the use of these articles.

"Those who are in the town weave all the year, those in the country, *at the outside, not above seven months in the year;* the remaining five months being occupied in agricultural employment. As nearly all the fathers of our weavers in the country are small proprietors themselves, the weavers are connected with the land, and are consequently not turbulent. Our industry, therefore, escaped the disasters, of which Lyons was the theatre in 1824 and 1832. PHIL. LEUTNER, Pére."

It appears to me, however, that the actual earnings of the weavers have not fallen in the same proportion as the rate of wages; except for the town weavers, it is, I need hardly remark, impossible to form any accurate estimate of their real condition, by the mere money-wages they receive; for the profits of agricultural occupation render their weaving wages merely an indefinite portion of their total income, which can only be estimated approximately.

It may be safely assumed, that a town weaver nets on the average 30 sous per day, and the country weaver 25, for 14 hours' work. They appear to me to work as hard as the Scottish weavers, though scarcely in the same manner: the latter will work desperately for three or four hours, in order that he may loiter and stand at his door an hour; the Tarare weaver, and the remark holds good elsewhere in France, keeps continually shuffling along, if I may so express it, and completes as much in 14 hours' sluggish work, as the Scottish weaver by broken portions of quicker work, extended over the same period.

The character of the Tarare weavers, is that of a quiet simple people, who have few wants, and but limited intelligence, in spite of the recent efforts of the priests to enlighten them.

In Normandy, the wages are very low among hand-loom weavers, who scarcely gain as much as those in the west of Scotland. They are the worst off in France, simply because they are rather more numerous in comparison with the demand for their labour. And the reason why they are so numerous, results from the easy sort of work done in that part of the country. Instead of muslins and silks, as at Tarare, Mulhousen, or Lyons, requiring skilled hands, and, therefore, limiting the number of those in the field of competition, Normandy produces pullicates, domestics, and other coarser articles. Consequently, I found the weavers there, *who had no means of other employment,* as badly off, or very nearly so, as in the west of Scotland, with which the goods produced by the Norman looms are in direct competition in third markets, whilst they nearly exclude us from their own.

At the same time, whilst the wages of Norman weavers are, if anything, lower than in Scotland, it must not be forgotten, that provisions are at least twenty per cent. cheaper, so that no great difference is perceptible in the condition of the two classes. And were I to be forced (putting love of country aside) to choose, whether I would be a pullicate weaver in Scotland or in Normandy, I think I should be sorely puzzled which to select; or rather which to consider the greater infliction.

The farmers here adopt the same custom towards the artisans as in Scotland, of allowing them land to set potatoes in, a custom very prevalent in Normandy.

The peasants live chiefly on vegetable soup, and the coarsest sort of bread.

The following are the ordinary wages earned in the Norman spinning mills, with which I was favoured by my friend M. Fauquet Lemaitre, one of the leading manufacturers of France:—

Spinners from 15 to 20 fr. per week, working from 80 to 84 hours. Women and girls, employed at the carding and drawing operations, gain from 7 to 10 fr. The power-loom weavers earn from 12 to 16 fr. per week.

Elbeuf is the largest cloth manufactory in France, and is rapidly increasing in the extent of its trade. The weavers here are in very easy circumstances. As there are no particular results from my inquiries at Elbeuf, beyond what are contained in the following letter to me, from the Maire of Elbeuf, who is also a very large manufacturer, and a most intelligent person, it will suffice to transcribe extracts from it.

"The working classes of our town of Elbeuf, enjoy, in general, easy circumstances; they have always lived happily for two very powerful reasons; the first, because our manufacturers are constantly in their workshops, work themselves with their workmen, know their wants, and identify themselves with all that happens to them, for good or evil: the second, because the price of weaving varies very little; the proportion between times of prosperity and times of distress, being 20 per cent. at most, in the amount of wages, and that only in certain departments.

"The work people are divided into three classes,—the adults, the day labourers, and the weavers.

"The adults receive a salary which varies according to their age, their strength, their intelligence, their age, from 75 cent. to 1 fr. 50 cent.; the largest number receive the average of 1 fr. 10 cent. I class as adults, young men from 12 to 18 years of age. Children from 9 to 12 gain 50 cent. to 75 cent. per day.

The day labourers taken at large from 18 years to 60, are paid from 1 fr. 50 cent. to 2 fr. per day, 1 fr. 75 cent. being the average. This class is but little intelligent.

"The weaver gains from 2 to 3 fr. per day; the ordinary average being 2 fr. 50 cent. The women receive from 75 cent. to 1 fr. per day. The young girls from 9 to 16 years old, earn from 50 to 80 cent. The day's work begins at five in summer, and ends at eight in the evening; half an hour for breakfast, and an hour for dinner. In winter they work from 7 to 10 hours.

At St. Quentin, in the north of France, the working classes make no complaint; they seem all of them pretty well supplied with the necessaries and many of the comforts of life. They are all well clothed, and have plenty of vegetables to eat; little meat is consumed or desired by them. In the country it is a common practice, as in Normandy, for the farmers to give the use of land for setting potatoes; only in the neighbourhood of St. Quentin the farmers usually find both seed and manure, receiving half the produce as their share. This is an advantage to the labourer, or he would not avail himself of it, though I have heard it doubted.

I was at some pains to estimate the wages in the spinning factories of St. Quentin, and I found 7 fr. (5*s.* 10*d.*) rather above the average per head paid per week, taking men, women, and children collectively. In Lancashire it is 10*s.* 6*d*

The rates paid are as follows at St. Quentin:—

	Fr.	Cent.		Fr.	Cent.
A spinner having under him at his own cost, two piecers, earns per day,	3	75	to	4	50
A woman or girl,	0	90	to	1	20
The piecers (children),	0	60	to	1	00
Power-loom weaver having two looms,	2	50			
Dressers,	3	00	to	3	50

"The weavers in the country gain—Children, from 6 to 12 sous (3 to 6*d.*) per day. The women, from 14 to 20 sous (7 to 10*d.*) The men, from 30 to 60 sous (1*s.* 3*d.* to 2*s.* 6*d.*)

"The work people in the town, of all ages and sexes, work 13 hours by day. In the country the hours are not regulated, but they work nearly as much as in the town, especially in winter. Nearly the whole of the artisans are paid by the piece, whether weavers or cotton spinners."

From my own investigations I am convinced that 30 sous (15*d.*) is rather above than below the average of the adult male weavers' earnings in the country.

Day labourers earn from 10 to 12 fr. per week. Mons. Lemaitre is further of opinion, that, though there is "very great distress" among the manufacturers and fabricans, there are very few of the working classes without employment. There is no question that the distress among the latter is confined to the weavers.

The price of food was as follows when I was at St. Quentin:—

Bread (white) 36 cent. per kilo., or 3½*d.* for 2⅕ lb. avoirdupois.

Beef (common sort) 55 cent., 5½*d.* per lb. of 18 oz.

Veal and Mutton, 65. cent. or 6¼*d.* per lb. of 18 oz.

Pork about the same price.

Rent is high at St. Quentin. A small room and closet costs 11 fr. or 9*s.* 2*d.* per month without furniture. In the country 3 or 4 fr. per month.

Coal is about 2 fr. 20 cent. the hectolitre.

Roubaix, near Lille, is the most thriving manufacturing district of France. The articles chiefly manufactured there are thibets, waistcoat pieces, and thick cotton goods.

There are about 12,000 looms in this district, of which half are jacquard looms. These latter are principally in factories; the manufacturers finding it necessary to preserve the privacy of their patterns.

The demand having increased so rapidly, wages have also risen. A weaver will, on the cotton goods, earn, on an average, 30 sous (15*d.*) per day; on the second class work, from 30 to 40 sous (15 to 20*d.*); and on the jacquard loom from 2 to 5 fr. per day, the average being about 3 fr.: these are gross wages. Net earnings will be weekly about 12 or 13 fr. for the jacquard weaver, and from 6 to 10 fr. for the plain weavers. Women and children obtain plenty of employment at the mills. Wages have risen by above one-third in the last few years.

Wages in most of the other departments of labour (not manufacturing) are for men, 2 to 3 fr. per day, and for women, 1 fr. 25 cent.

Thibets of woollen weft and warp, 11°° 3 shots over, chains No. 22^s, weft No. 38^s. Wages 17 sols (8½*d.*) per ell of 44 inches, amounting to about 20 or 22 fr. on an average per week, out of which the weaver pays for winding, weft, and every thing but winding the chains. The earnings of

the weaver, therefore, on these goods could not be less than 2 fr. 50 cent., or 2*s.* per day, for 14 hours' work; and weavers have admitted as much to me.

I inspected a woollen spinning factory belonging to Mons. Delatre. The spinners were earning from 20 to 24 fr. per week, net, as a matter of course; and I was assured that the previous week one man had received for seven days' work, no less than 60 fr., out of which he had, however, to pay 19 fr. to his piecer; and it is by no means uncommon for them to earn 30 fr. net. The girls earned about 7 fr. 50 cent. per week, and the children 3 fr. per week.

I was assured that they worked 15 hours in this mill. If so, I can only say I never saw healthier looking people in any factory, except that of Mr. Edmund Ashworth's of Egerton. The rooms were all high, clean, well ventilated; and the machinery, though not of the newest description, extremely good.

There are several weaving villages in the north of France, but none of which exhibit any features in the rate of wages worthy of particular note.

At Tourcoing, for instance, the weavers gain about 9 or 10 fr. gross per week; these wages have been augmented by about a tenth during the last ten years.

The other working classes (adult males) gain from 1 fr. 75 cent. to 2 fr. 25 cent. per day.

The weavers are the most moral class in this town; they attend to the education of their children, and seem contented with their condition. The price of food was last year:

Bread, 32 cent. ($3\frac{1}{3}d.$) per kilogramme ($2\frac{1}{5}$ lb.)
Meat, 1 fr. 10 do. do. do.
Coals, 2 " 25 do. (1*s.* 10*d.*) per hectolitre of 22 gall.
Rent, average for weavers, 100 fr. (4*l.*)

At *Havre*, the average amount of wages of a male labourer is in the country, 2 fr. = 1*s.* 6*d.*, in summer; and 1 fr. 50c. = 1*s.* 2*d.*, in winter, without food; in towns, it is 2 fr. 50 c. = to 2*s.* a day, all the year.

A labourer's wife and four children, aged 14, 11, 8, and 5 years respectively (the eldest a boy,) earn in a year, 1000 fr. (40*l.*), provided the two eldest children are employed.

The rent of the labourers' habitations, from 50 to 100 fr. = 2 to 4*l.* a year.

In the south western provinces;

The wages of an able-bodied male labourer, by the year, amount to	425 fr. =	17*l.* 0*s.*
A house and garden is found him, valued at 60 fr. per annum, ...	60	2 8
In addition to the above sum, he receives four hogsheads of piquette, (a beverage made by pouring water over the residue of the grapes and lees of new wine), valued at . . 25 fr.		
Wood, for fuel, valued at . . 30		
	55	2 4
Total for the year,	540 fr. =	21*l.* 12*s.*

The wages of a day labourer are 1 fr. 50 c. (1*s.* $4\frac{1}{2}d.$)

A labourer's wife and four children can earn, by labour, about 300 fr. (12*l.*) per annum, viz.

The wife,	120 fr. =	4*l.* 16*s.*
Eldest boy,	80	3 4
Child 11 years old,	50	2 0
Child 8 do.	30	1 4
Child 5 do.	20	0 16
Total,	300 fr. =	12*l.* 0*s.*

Dr. Bowring, in 1834, collected the following returns, which I have revised:

In Paris—		Fr.	Ct.		Fr.	Ct.
Gunsmiths	earn per day	3	50	to	4	00
Jewellers	do.	3	50	to	4	50
Toymen	do.	3	00			
Capmakers	do.	2	50			
Butchers—they are boarded, and may earn from 1000 to 1200 francs per annum.						
Bakers	earn per day	4	00	to	4	50
Brewers—they are boarded, and may earn 500 francs per annum.						
Hatters	earn per day	3	00			
Carpenters	do.	3	00	to	3	50
Cartwrights	do.	3	00			
Shoemakers	do.	3	00			
Carvers	do.	4	00			
Nailers	do.	3	00	to	4	00
Ropemakers	do.	3	00			
Cutlers	do.	3	00			
Gilders	do.	3	50	to	5	00
Cabinetmakers	do.	3	50	to	5	00
Tinmen	do.	3	00			
Engravers	do.	5	00			
Watchmakers	do.	3	50	to	5	00
Printers	do.	4	00	to	7	00
	do.	2	50	to	3	50
Masons	do.	3	00			
	do.	2	00			
Marble cutters	do.	4	00			
Joiners	do.	3	00	to	3	50
Goldsmiths	do.	4	00			
Papermakers	do.	3	50	to	4	50
Perfumers	do.	3	00			
Lacemen	do.	4	00			
Pastrycooks—they are boarded, and earn from 600 to 900 francs per annum						
Paviers	earn per day	3	00			
Plumbers	do.	3	00	to	3	50
Plasterers	do.	2	50	to	3	00
Porcelain-makers	do.	3	00			
Soap-boilers	do.	2	50			
Saddlers and Coachmakers	do.	3	50			

		Fr.	Ct.		Fr.	Ct.
Locksmiths .	earn per day .	3	00	to	3	50
	. do. .	4	00			
Stonecutters .	do. .	4	00			
Tailors .	do. .	4	00			
	do. .	5	00	to	8	00
Turners in wood .	do. .	3	00			
Upholsterers .	do. .	3	00	to	3	50
Dyers .	do. .	3	00	to	5	00
Tanners :	do. .	3	50	to	4	00
	. do. .	6	00	to	15	00
Terrace-makers	do. .	2	00			
Coopers .	do. .	3	00			
Do. They are also boarded, and get as wages 500 francs.						
Turners in Metal	earn per day	4	00			
Blacksmiths	do. .	3	00			

With regard to the food of these workmen, the terrace-makers and labourers live very economically, not expending more than from 16 to 17 sous per day: in the morning they repair to the low eating houses, called Gargotes, where for 7 sous they get soup, and a plate of meat with vegetables; their custom is to breakfast on the soup and vegetables, and carry the meat away with them for their dinner.

Thus, these 7 sous, two pounds of bread 8 sous, and perhaps for wine 2 sous, make 17 sous.

The masons, paviers, locksmiths, &c., do not exceed 20 or 21 sous; their only addition to the above being 4 or 5 sous for supper.

Carvers, gilders, saddlers, printers, &c., spend about 30 sous per day; viz. soup and meat for breakfast 7½ sous, dinner 7½ sous, wine at do. 6 sous, two pounds of bread 9 sous. The higher paid artisans spend at least 35 to 40 sous.

In the iron works at Vandelesse (Nievre), the price of labour is 1 fr. 70 c. per day; at Nevers, for manufacture of iron-cables, 2 fr.; at Fourchambault, 1 fr. 60 c. is the average rate; the workmen in the potteries at Nevers gain 1 fr. 75 c. per day; at Nogent, in the manufacture of linen goods, the wages are, to men 2 fr., women 1 fr. 25 c., and children 60 to 90 c. per day; at Mouy, in the woolen manufactures, men are paid from 1 fr. to 1 fr. 50 c., and boys of fifteen 1 fr. In the Department de l'Aube, the weavers of fine cloth get 1 fr. 75 c.; stocking-makers, 1 fr.; cotton spinners, 1 fr. 50 c. per day; reelers and winders, 1 fr.; tanners, 2 fr. to 2 fr. 10 c. At St. Etienne, the wages paid to the miners are, diggers, 3 fr. 50 c.; drawers, 3 fr. per day. At Rieve de Gier, 4 fr. 25 c., and 3 fr. 50 c; nailers receive either 7 to 10 c. per lb., or from 1 fr. to 1 fr. 50 c. per 1000. The tenders on silk worms are paid from 50 c. to 1 fr. per dry. Women employed in reeling silk receive 1 fr. per lb. At the forge of Janon (Vienne), a master founder is paid 8 fr., a founder 4 to 5 fr., a labourer 2 fr., and a boy from 1 fr. to 1 fr. 25 c. per day. At Rive de Gier, the labouring makers of coke receive from 2 fr. to 2 fr. 50 c. per day.

The "Ponts et Chaussées" pay their labourers 36 fr. per calendar month.

The food varies in different districts. Throughout the district called *Landes* (Heath), occupying about one-third of this department, the food consists in rye bread, soup made of millet, cakes made of Indian corn, now

and then some salt provision and vegetables, rarely, if ever, butcher meat; their drink water, which, for the most part, is stagnant.

In the other parts of Southern France, the peasantry live better. They eat wheaten bead, soup made with vegetables, and a little grease or lard twice a day, potatoes and other vegetables, but seldom butcher meat; their drink is wine or piquette; a family, composed as above, could lay something by from their gains at the end of the year, as the wants of the lower classes are much fewer than in England; in fact, the luxuries of tea, &c., are quite unknown.

I can corroborate most of these statements from my own observations.

Wages in Switzerland, and Physical condition of the Artisan Peasantry.

I am loth to speak of the wages of Switzerland. The pecuniary amount of wages is at all times a fallacious index to the real condition of the labourers. In Switzerland it is peculiarly so, owing to the very great subdivision of land, and the intermixture of agricultural and artisan occupations, a vast number of the working classes producing a portion of their own subsistence.

This and other peculiarities render the money wages of the Swiss artisans so inadequate a criterion of their eminently happy and prosperous condition, that I cannot too strongly caution my readers against making the former a measure of the latter. There is also another peculiarity in the supply of labour in certain branches of trade, common not only to Switzerland but to a large portion of Germany and Austria, which it is necessary to describe. I allude to the *Wander-schaft* system. By immemorial usage, no apprentice can obtain his freedom and become a master until he has spent so many years under his itinerant probation, and in following his avocation beyond his native country. He is furnished, on setting out, with a book, in which his various masters insert certificates of his service and conduct. This is called a "*Wanderbuch.*" The journeyman is generally assisted not only by the trade to which he belongs, in towns where there is no employment for him, but by the donations of travellers. This part of the system I think objectionable, for it decidedly removes that abhorrence of dependence, which it is so essential to inculcate, as an element of physical, as well as of moral, welfare. I have been frequently asked by well dressed men, with a knapsack on their backs, for money on the road. However, from one of those who asked charity of me I derived a great deal of valuable information; he had been through Switzerland, part of Bavaria, and Wurtemberg, and was then on his way home to Baden. He spoke French admirably, and gave me an excellent account of the most salient features in the condition of the workmen in the different counties he had been in; and I need hardly say how greatly the experience they gain in their travels must tend to improve them in their trade, and, what is far more important, to add materially to their knowledge and mental capacity. I object, however, decidedly to the practice of begging, which cannot but remove the reluctance to so degrading a resourse in after life when distress may arise, without the palliation which custom affords to the journeymen. In every other respect it appears advantageous; and in point of intelligence, I can speak from personal knowledge to the fact, that these journeymen on the Continent very far surpass the same class in this country in general education.

Mr. Kennedy of Felkirch favoured me with some written remarks on this interesting subject, which, from his long residence in Austria, no one more fully understands:—

"You are aware that here, as over almost every part of Germany, the trades of tailors, shoemakers, furriers, &c. &c., are carried on by masters who employ journeymen on the Wander-schaft as it is called, that is to say, workmen who go from town to town, stay a winter at one place, a summer at another, and receive generally, besides board and lodging, a certain sum weekly. This is usually about a dollar (3*s.*) to 3 florins (5*s.*); tailors 20 per cent. less. When they go from one town to another, it is a recognised privilege of theirs from time immemorial to ask assistance from passers-by as they travel along, and at the towns they pass through; and at every town there is a "*hepberge*," as they call it, where the master of the inn has agreed with the guild of that trade to lodge them at a very low rate; so that when they arrive, they immediately ask for the tailors' or shoemakers', &c., herberge, and by that means can travel very cheaply; a very bad system, which was originally intended to give them an opportunity of improving themselves in the knowledge of their art, but it is peculiarly favourable to vagabondising. At the moment I am writing this, a silk weaver has applied to me for assistance. From his passport I see he has been in Italy, and then in Hungary, and is returning to the Grand Duchy of Nassau, whence he came. Of course, in the large towns, they have the system of piece-work in a much greater degree."

In the linen districts of Berne, the weekly average wages (net) of the weavers were as follows:

1. For the best damask (skilled workmen),	10 fr.	= 8*s.*	4*d.*
2. For second class do. . .	8 50 cent.	7	1
3. Plain webs, . . .	7	5	10

The condition of the weavers is exceedingly good; they not only possess all the comforts of their class in life, but, excepting merely the cases where a large and young family has to be provided for, considerable savings are amassed by the Bernese linen weavers.

The price of food and lodging is so moderate in the neighbourhood of Langenthal, that an adult is able to support himself with ease on fivepence per day.

I confidently believe, that it would require 30*s.* per week in England, in the neighbourhood of any country town, to put a man, his wife, and three children (two of whom shall be above 15 years of age), in the same condition, and in all physical respects, on a footing with the average of Swiss artisan peasants having the same family. This statement requires a little explanation. I assume that an English family thus circumstanced, where provisions were of the average price in England, might be supposed to expend their 30*s.* somewhat thus:—

Rent of cottage of 4 rooms, per week, .	1*s.*	6*d.*
Bread, 26 lb. weight, . .	5	0
Bacon, 8 lb. at 9*d.* . . .	6	0
Coal, 2 cwt., or other fuel, year through, .	2	6
Potatoes, or other vegetables, 1 bushel, .	2	0
Beer, 14 quarts, 8*d.* per gallon, .	2	4
Tea or coffee, 2 oz. at 5*s.*, . .	0	8
Sugar, 1½ lb. at 8*d.* per lb. . .	1	0
Butter, 1½ lb. at 1*s.* 2*d.* per lb. . .	1	9
Cheese, 1 lb. : . .	0	9
Milk, 3 quarts, : . .	0	6

Soap, 1 lb.	0*s.*	7*d.*
Candles, 1 lb.	0	8
Tobacco, 1 oz.	0	3
Man's clothing (one suit, 2 pair shoes and stockings, per year),	1	6
Woman's do. (two suits per year),	1	0
Three children (do. each per year),	1	6
Club,	0	6
Sundries	0	6
	30*s.*	0*d.*

Of course, the value of these articles will vary in different parts of England; but I believe the amount of comforts and necessaries to be purchased for 30*s.* a week, will on the average, be found to tally with the above statement.

I fearlessly assert, that that amount of comforts and necessaries, *mutatis mutandis*, is enjoyed by the bulk of Swiss artisan families in the German cantons of Switzerland. This is an assertion which cannot be set aside by mere *ipse dixit*. They who may desire to do so can alone ascertain its validity by personally visiting the homes of the Swiss peasants at different hours and in various cantons. I am not afraid to submit this statement to any one who has thus qualified himself to pronounce an opinion on the subject.

I am, moreover, impressed with a confident belief that the working classes of northern Switzerland, enjoy a greater amount of physical comfort, and of mental cultivation, than the working classes of any other European community.

Unmarried men and itinerant workmen are, for the most part, boarded in the houses of small proprietors.

The sums raised for the relief of the impotent poor are very trifling, and never, even where no institutions exist for their support, bear any comparison with poor-rates in England.

The price of food necessarily varies greatly in different cantons, as the transit-tolls, which constitute a great part of Swiss taxation, make provisions comparatively dear wherever they are not the produce of the canton in which they are consumed. The following will be found, however, a tolerably correct average for the majority of the German cantons.

Bread fluctuates from 1*d.* to 1¾*d.* per lb. of 17 ounces: the average is 1½*d.* for common bread, *i. e.* one batz of Zürich. Meat varies from 2½*d.* to 4½*d.* per Swiss lb.; average price, 3*d.* Potatoes, 20*d.* per sack of 33 gallons; but the fluctuations are very great. Milk, from 5 to 7 farthings per pot of 3 pints. Wine, for workmen, 3*s* 4*d.* per quart. Wood also varies much, from 20*s.* to 30*s.* per cord of 90 feet.

The meals of the Swiss consist more of porridge than is general in England; and much more milk and cheese are consumed. In other respects (wine and cider being substituted for beer), the catalogue of articles I have given above will scarcely differ in the two countries. The amount of meat I have purposely stated rather low.

Wages were higher, as in England, during the war; for persons knowing how to weave were then smaller than they now are in proportion to the demand for woven goods. The peace returned a number of soldiers to the country, and weaving very soon resumed its rank among the lowest of arts.

The high education of the Swiss soon taught them to perceive that a handi-

craft, at least as far as plain weaving is concerned, requiring the skill of children and the strength of women, must necessarily be remunerated by the wages of children's and women's labour. Weaving, therefore, except in the fancy work, has long ceased to be a separate employment; and exists but as the occupation of children, women, and elderly men, or as occupying the intervals of higher branches of adult industry.

A very important effect results to the economy of wealth from this system. It appears that, by this junction of manufacturing and agricultural industry by the same persons, an augmentation must accrue to the production, and consequently to the wealth, of the country. An agriculturist in England seldom works after four o'clock in the afternoon: the Swiss agriculturist, on the contrary, occupies himself at the loom not only in the evening, but during bad weather, and in winter, when the English farm-labourer is idle. The loom, which is here an exclusive and starving occupation, is there a pastime of supplementary production. It is, I think, manifest that the Swiss system increases the wealth of the nation; but it must be remarked, on the other hand, that were the sort of out-door labour performed by the Swiss artisans the same as that of the English labourers on arable farms, instead of being chiefly horticultural and pastoral as in Switzerland, it is questionable whether the hands inured to the plough, the flail, and the pitchfork, would be fitted for the weaving of muslins and ginghams for evening amusement.

TO BE CONTINUED.

On Beet Sugar. By J. C. Booth.

There are few subjects which have created more sensation in the greater part of Europe, and the United States, simultaneously, than the manufacture of sugar from beet root. That it should have induced many individuals in this country to experiment, with a view to its manufacture, the characteristic enterprise and ingenuity of our people might guarantee, but may we not assign as the chief reason of their failure, or only partial success, the fact, that too many of us still boast of our practical knowledge, with a sidelong sneer at the assistance of science. It is rather more surprising, to observe the intense and all pervading interest manifested on various parts of the continent of Europe, especially in Germany, on the sugar-beet and its important product, as it clearly shows that this learned people has received an impulse with the rest of the world, relative to more modern manufactures, or rather that the zeal with which scientific men have devoted themselves to the advancement of the arts, is now developing its effects on the mass of the community. The frequent questions asked relative to the making of beet-sugar, may be better answered by a concise description of the superior method of extracting sugar from the dried beet, the main part of the account, being taken from Dingler's Polytechnic Journal, for 1838, Bd. LXIX. The drawings in all their details will be omitted, and merely the general features of the process described.

1. *Cleansing.* They must be washed, to free them from the soil which adheres to them, and this may be executed in a simple tub, or on a larger scale, a vat, into which water flows. A convenient arrangement for this purpose, might be a net-work cylinder, slightly declining from a horizontal position, revolving under water, or through which water should abundantly flow. The beets coming out from the depressed end of the cylinder, will be perfectly clean.

2. "*Cutting.* They are next cut by a machine into long strips, exhibiting a square by a cross section, i. e. into long parallelopipeds, which is ac-

complished by a series of small knives attached to a sheet of iron, parallel to, and at short distances from, each other, which first make incisions as deep as the required thickness of the pieces, and are followed by a long knife, behind and at right angles to the smaller ones, by which the strips are separated." The knife with the smaller ones, cut by a vertical motion, but there might be a greater economy of time, by bringing a series of these cutters on a wheel, and attaching the smaller knives to the large one, suffering them to project a little below it, so that their incisions may be immediately followed by the edge of the long knife.

3. *Drying.* "Various and simple arrangements have been devised, for drying the pieces thus cut, in all of which, the principle consists in exposing them in thin layers, to a current of air, heated to a temperature of between 100° and 145° Fah.; for if below 100°, they are apt to ferment, and if above 145°, they are liable to decomposition. For this purpose they are placed on wire nets, in the form of drawers, to the depth of one or two inches, the drawers sliding in one over another, at the distance of three inches, to allow of a free circulation of air. The drying chamber, or house, is heated, either by a hot-air furnace, or by steam tubes. A better arrangement, however, and one requiring but little hand-labor, is a series of endless wire-nets, one over the other, and each passing around a roller at each end. The pieces are carried from the cutting machine, on an endless cloth, up the highest of the nets, on which they fall, and are carried to the farthest end, by its constant motion, where they fall on the next lower endless net, which at this end projects beyond the uppermost, moving in the opposite direction on to the farther end of the second, which does not reach as far as the third, they are received on the latter, and again transported to its farther end, and thus by moving alternately in opposite directions, on the adjoining nets, they reach the lowest, from which they are thrown off in a dried, or sufficiently dried, state for use. These parallel nets are all in a chamber, heated by steam tubes from below; lower openings in the apartment, admitting cold and dry air, the upper ones above the nets, permitting the egress of the hot air surcharged with vapor. After drying they are ground to powder."

4. *Sugar extraction.* "The saccharine matter may be extracted by pure water, but it is found to be more advantageous to add acid, or lime, to it. The former is preferable, and sulphuric acid the most convenient. To nine parts of water add two-thirds or three-fourths of a pr. ct. of sulphuric acid, (according to the amount of sugar in the beets,) and stir in four, or even more, parts of the powdered beet. The stirring should be continued until the acidulated water is absorbed, when the mass is subjected to pressure in bags; the remaining mass is again treated with the same quantity of equally acid water, and pressed, but the liquid thus obtained, is used for the next fresh quantity of powder. The moistening and pressing are continued until all the sugar is extracted.

The portion first pressed out, is treated with a quantity of slaked lime a little more than sufficient to neutralize the acid, and the precipitation of sulphate of lime, takes place fully at the temperature of 165° to 190°. Fahr. The clear liquid is drawn off and crystalized by the ordinary sugar-refining process."

5. *Theory.* Beside sugar, there are many other vegetable principles contained in the beet, of which gluten and albumen are most injurious and difficult of management, but by drying they are rendered insoluble, and cease to be troublesome. It is also in consequence of the same operation, that less animal charcoal is required for purifying the sirop, than where the beets were

not dried. Sulphuric acid renders more insoluble the gummy matter, and probably decomposes a combination of a portion of the sugar, but as there are other acids also present, a little more lime is added to neutralize them, than is sufficient for saturating the sulphuric acid. The beet may contain from six to twelve pr. ct. of sugar, but much of it is lost in the process of manufacture. It is similar to that obtained from the sugar-cane, and is hence called cane-sugar, to distinguish it from other varieties, as raisin or starch-sugar, sugar of milk, &c.

On Raisin Sugar. By J. C. Booth.

When raisins have been exposed to the air for a length of time, small crystaline grains will be found upon and within them, which have a sweet taste and are a species of sugar. The same kind may be made by the action of diastase, or sulphuric acid, on starch, and indeed starch-sugar, or rather starch-sirop is much used in parts of France and Germany. The process of manufacture is as follows:

1. *Conversion of the starch.* One thousand parts of water are brought to the boiling point, in an open vessel of copper or lead, and fifteen parts of sulphuric acid added, previously diluted with thirty parts of water. When the fluids are well mingled, a cover is put on the vessel with a small opening in its centre through which the starch is introduced. Four hundred and fifty to five hundred parts of dry starch, (or as much wet as contains this quantity,) are put into the opening, in the cover of the vessel, in very small portions at a time, so that the fluid may continue boiling and not become thick. A few minutes after the last portion is added, the fire is extinguished, and chalk is thrown in to neutralize the acid. The clear liquor is drawn off, when the sulphate of lime has deposited and filtered through ordinary sugar filters. It is then evaporated to one half its volume, twenty-five parts of animal charcoal stirred in with a little blood, boiled and filtered through Taylor's filtering apparatus. This is starch-sirop, from which sugar may be obtained, by evaporating to 40—45° Baumè and cooling. It forms a white, coarsely granular mass, from which the molasses may be separated in the ordinary manner. One hundred parts of dry starch, give one hundred and fifty parts of syrup, or about one hundred of dry sugar.

2. *The Theory of the process.* The conversion of starch into sugar, by this process, is one of the most singular operations of chemistry, and has given rise to a new doctrine in the science. We perceive that by the operation on a large scale, they obtain an amount of sugar equal to that of the starch, but De Saussure obtained in a careful experiment, from one hundred of starch, one hundred and eleven of dry sugar. The sulphuric acid is unchanged, for there is the same amount remaining after the operation that was originally introduced; nothing is absorbed from the air, nor is there any evolution of gas, for the operation may be conducted equally well in closed, or in open vessels. The starch alone has changed, and this change is effected by its taking up a certain quantity of water, or rather the elements of water, hydrogen and oxygen. According to Saussure, one atom of starch takes up about two atoms of water. It appears then that the presence of sulphuric acid is sufficient to produce such an alteration among the elements of starch, that a new and different product results. For this reason and from many analogous facts, the French chemists give to this singular method of decomposition, the name of *presence;* Berzelius calls it *catalysis,* which signifies a decomposition, by the interchange of the elements of a

body among each other. The catalytic influence of sulphuric acid then, is to convert starch into sugar, where water is present. All other acids will produce the same result, and the same kind of sugar may be obtained in a similar manner, from other organic substances, such as linen, cotton, wood, &c. But the change is not immediate, for it is observed to convert the starch first into gum, and the gum into sugar. It is, however, not the mineral acids alone, that produce this effect, for an organic substance has been discovered in malt, which possesses the same power in a higher degree. This is diastase, which converts starch into gum, (or dextrine,) at a temperature of 150° to 160°, while the mineral acids require 185° to 205°. One part of diastase will change two thousand parts of starch into dextrine, and at least one thousand parts into sugar. Through the presence of diastase, therefore, or more properly by its catalytic influence, starch of wheat, potato, &c., is first changed into dextrine, and then into sugar; a highly interesting fact, as giving us a clearer view of the formation of gum and sugar in plants, and of the processes for manufacturing alcoholic liquids, which require the presence or formation of sugar, prior to their vinous fermentation.

In concluding the above articles on the manufacture of two varieties of sugar, the following table of the amount of sugar consumed in Europe, in 1836, may not be uninteresting. It is extracted from Dingler's Polyt. Jour. lxvii. p. 319.

Kingdoms of Europe.	No. of millions of Inhabitants.	Su gar lb.	lbs. for one individual.
England,	16¼	321½	20
Ireland,	8	32	4
France,	33	178¾	5⅓
Prussia,	14	56	5
Bavaria,	4	10	2½
Switzerland,	2	12	6
Belgium,	4	60	15
Holland,	2½	35	14
Denmark,	2	10	5
Sweden and Norway,	4	12	3
Spain,	14	87	6¼
Portugal,	3½	16½	5
Smaller German states,	8	40	5
Italy,	18	36	2
Austria in the commercial union,	19	40	2
" without " "	15	25	1⅔
Russia,	40	40	1
	207¼	1011⅛	

Copal Varnish.

The following method of preparing a copal-varnish, is not novel, but its simplicity and the superior quality of the product, may render it acceptable to many of the readers of the Journal.

Enclose coarsely-powdered copal in a linen rag, and hang it in the neck of a flask, or bottle, to such a depth that it cannot touch the spirits of wine, which is in the bottom of the vessel. Tie a piece of bladder over the

mouth of the flask, and make a few perforations with a pin, for the escape of a little alcoholic vapor. If the vessel be placed in a warm situation, thick and viscid drops of the copal, combined with alcohol, will slowly fall into the liquid below, and gradually dissolve, until the whole of the copal is extracted. When dissolved, the clear liquor may be decanted from a very small quantity of sediment, and it will prove a more transparent and beautiful varnish, than can be procured by any other method. The same process is applicable to other difficultly soluble resins, and will be found useful where rapidity is not required. B.

Soda-Manufacture in Hungary.

Native carbonate of soda is found in greatest abundance in Little Cumania, particularly near Shegedin; it likewise occurs in many other places, in greater or smaller quantity. It effloresces, out of the moist earth, forming a white crust, and in the spring of the year, before sunrise, it appears like an extensive covering of snow. With greater care than they now employ, the workmen might readily gather it sufficiently pure for ordinary technical purposes by raking. The whole of the surface is gathered, and sold to the soda manufacturers, who distinguish its quality and richness, by the taste. It is leached in square vats, until the remainder ceases to have a saline taste. The fluid is dark brown, and beside carbonate of soda, contains much sulphate and muriate of soda, humic acid, and other mechanical impurities. It is boiled down in a large sheet-iron pan, to a siropy consistence, transferred to an adjoining pan, and evaporated to dryness under constant stirring. The mass is of a dirty yellow, or brown, with white and black spots. It is gradually heated in a calcining furnace with the access of air, until vapors cease passing off, then fused at a higher temperature and taken out, when partially cooled. A large portion is employed in the country itself, in the manufacture of soap, the remainder sold as raw calcined soda, as there is no manufactory for crystalizing it. If the demand for it were increased, the production of this salt might be increased to three or four times the present amount, as the country contains numerous soda lakes. Beside Trieste, from which some of the productions of Hungary, find their way to the American market, there is a port on the Adriatic, belonging exclusively to that kingdom, whence we might obtain, at lower rates, the products of one of the most fertile countries of Europe.

Selected from Erdmann's Journal, für praktiche Chemie, Bd. xiii.

B.

On Galls used in the manufacture of Black Ink.

Blue aleppo galls are employed in great quantity, in the manufacture of black ink, in consequence of the large amount of tannin they contain, nearly all of which, by a judicious management, is converted into gallic acid. Being greatly superior to oak bark in their content of tannin, they might be substituted for it, in the process of tanning leather, were not their high price a serious impediment. They are excrescences on the leaf-stem of the quercus infectoria, growing in the Levant, and are produced by the incision of the female gall-wasp. There is, however, another kind of galls, the acorn of the Quercus cerris, which receives a malformation from the incision of an insect, and produces a substance not unlike the aleppo galls, but much more irregular and with bold projecting points. They are found abundantly in Hungary, and the Southern provinces of Austria, where they are employed in dyeing and tanning, particularly in the latter art. They

are known under the name of Knoppern, in Germany, and Galles à l'epine, in France, and in the former country, are considered but little inferior to good aleppo-galls. A manufactory has been established at Vienna, for obtaining a solid extract from them, which has been successfully employed, in dyeing dark colors, and in tanning. Either the knoppern, or their extract, might be obtained at Trieste, and might prove a useful substitute for ordinary galls, whether in dyeing, or in the manufacture of ink. J. C. B.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Assay of Gold.

In the last number of the Journal, a new method of assaying gold, proposed by Lewis Thompson, Esq., is extracted from the London and Edinburg Philosophical Magazine. It consists in adding to the gold assay-piece, an excess of silver, and then fusing the mass down with the chlorides of silver and of sodium, to remove the base metals. The silver is afterwards separated by nitric acid. "By this plan," says the author, "the tedious process of cupellation is avoided."

It may not be unimportant, to some of the readers of the Journal, to be informed, that Mr. Thompson's plan differs from the usual one by cupellation, only in two particulars, in both of which the old process has manifestly the advantage. In this process, lead alone is employed to remove the base metals, instead of the two chlorides, and it is simpler, perfectly effectual, and not subject to decrepitation. The second point of difference, is that a cupel, composed of bone ashes, is used instead of a crucible; and this cupel possesses the invaluable property of absorbing the oxides of lead, and of the baser metals, and leaving a clean button, composed only of gold and silver. In the new process, this advantage is not presented, and there will be grains to be separated from the crucible, as after the operation of fluxing;—thus adding not only to the labor of the process, but to the uncertainty of the result. We are, therefore, led to the conclusion, that the process proposed by Mr. Thompson, is more complicated, more inaccurate, and even more "tedious," than that now in universal use. U. S. M.

Postscript.

Some time after the above article was communicated, an opportunity was taken of making trial of Mr. Thompson's method of assay, and the results render it proper to modify, in some degree, the above remarks. The gold, the fine silver, and the chloride of silver, were melted together in a small crucible, and the button of gold and silver formed was found to be much more perfect and better insulated than had been expected. Five assays were made, and the results, by the old and the new process, expressed in thousandths, were as follows:

No. 1, by cupellation,	968	by Thompson's process,	968.5
2,	"	890	"	889.
3,	"	936.5	"	936.7
4,	"	900	"	900.2
5,	"	460	"	460.5

This comparison of the two methods is certainly very satisfactory, the greatest difference being but one thousandth.

In employing Mr. Thompson's process, an evil was observed which had not been anticipated. It is, that a sensible portion of the chloride of silver is volatilized during the fusion, and consequently lost. To show this, the fol-

lowing statements of the first and last assays—being of the finest and basest specimens, are presented. The weight 1000 is equal to between 7 and 8 grains.

No. 1,	Gold, with silver,		1000: no copper
	Fine silver,		2000
	Chloride of silver,	2700 =	2037 fine silver.
			5037
	Button of gold and silver after melting,		3088
	Loss of silver by the process,	=	1949
No. 5,	Gold, with silver,		494 + copper 506
	Fine silver,		1400
	Chloride of silver,	3000 =	2260 fine silver.
			4154
	Button after melting, . .		2580
	Loss of silver, . .		1574

On the whole, though the new process is certainly not so good as that by the cupel, and is not likely ever to replace it where numerous assays are to be made, as at a mint, yet it is certainly better than was supposed when the above remarks were made, and it has the advantage, which is valuable under many circumstances, of not requiring a muffle furnace, or a cupel of bone ashes. U. S. M.

TO THE EDITOR OF THE JOURNAL OF THE FRANKLIN INSTITUTE.

Description of an improved Faucet, for drawing thick and drying liquids.

Sir,—I send you a description of a Varnish Faucet, particularly adapted to drawing thick, and drying liquids, such as varnishes, oils, molasses, &c.; to prevent its being patented by some future inventor, and that it may be made public, if it should be thought worthy.

All common kinds of cocks, or instruments for drawing liquids, have an interior surface below the closure, or place where the liquid is shut off, which is exposed to the air, and which receiving a fresh coat at every draught, when used for varnish, soon gets filled up, and the instrument is thus rendered useless, unless it can be cleaned out. To obviate this difficulty, and several others, I contrived the instrument, now to be described, which I have had in use for several years, and found to answer admirably well.

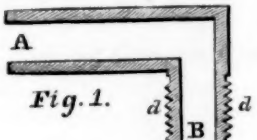


Fig. 1.

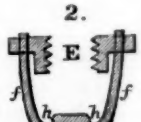


Fig. 1 represents a section of the tube, which may be made of any suitable metal, or composition. (As we have no brass founder here, I had one turned out of cast iron.) A, is the end which is soldered into the canister.

At the orifice, at B, is turned a small bevel, as shewn at *c*, *c*. On the outside of the pendent part, is cut a coarse threaded, or double threaded screw, *d*, *d*, on which fits the nut E, (fig. 2,) having a rim, or flanch on the upper part, in which two holes are drilled opposite each other, to receive the ends of the bent wire, *f*, *f*, riveted fast there. A conical, or proper shaped, hole is made in a piece of wood, the bend of the wire inserted, and the hole filled with tinner's solder, to form the stopper. This is to be rasped into its proper shape by giving it as little surface as possible, leaving it long enough, so that the liquid which is to run over it, will follow it down, and run off at the blunt point, *g*. The annular bevel *h*, *h*, is to be fitted accurately to the bevil *c*, *c*, by trials. By screwing the surfaces tightly together, a small impression is left on the tin and lead, which will indicate where it is further to be cut away. When the impression is continuous round the whole beveled ring, it will then close perfectly tight. There will generally be play enough in the screw, to admit a more perfect indentation on the bevel of the stopper, being made by a hammer, by placing the point *g*, on soft wood, and striking on the tube above. The nut is turned by placing the thumb and finger on the rim, the circumference of which, may be scolloped.

The disadvantages of this instrument, in comparison with others, are, that it costs more, that the point must necessarily extend downwards, more than convenient, and that in drawing thin fluids it will scatter. This may be obviated, by attaching a tin funnel-shaped hood to the nut.

Its advantages are, that it is strong, easily worked, and not liable to get out of order; that it can, at once, and with the greatest ease, be shut perfectly tight, even under the greatest head, or pressure, that can possibly be put upon it, as the fitting surfaces are quite small, (the ring presenting the least possible amount of surface, which must be brought into contact, to close the same, or an equal section of aperture,) and are brought directly together, by a screw power. Lastly, there is no internal surface exposed to the air, to be clogged up. Concretions on the stopper, can at any time be scraped off, and if suffered to remain, cannot stop the faucet from operating.

Yours,

AMASA D. SPROAT,
Druggist, Chillicothe.

Chillicothe, Ohio, May 28th, 1840.

Civil Engineering.

General Demonstration of the Prismoidal Formula, used in Excavation, Embankment, and Masonry calculations. *By* ELLWOOD MORRIS, *Civil Engineer.*

In the number of this Journal, for January, 1840, the writer endeavored to develope a mode of measuring excavation and embankment solids, which upon the general *Hypothesis that the surface of all ground is composed of planes, longitudinally and transversely, and free from twisted surfaces*, may be regarded practically as accurate.

This method was made to depend essentially upon two points.

1st. That the formula, expressing the capacity of a prismoid, is the *fundamental rule*, for the mensuration of all right lined solids, whose terminations lie in parallel planes, and is equally applicable to each.

2nd. That any solid, whatever, bounded by *planes*, and parallel ends, may be regarded as composed of some combination of prisms, prismoids,

pyramids, and wedges, or their frustra, having a *common altitude*, and hence capable of computation by the general rule alluded to.

From these premises, the inference was drawn, that any such solid, (the middle section of which, parallel to the ends, could be ascertained,) was susceptible of accurate determination: and consequently as the mid section of any given portion of excavation or embankment, can be correctly deduced from the data, usually taken in the field, that therefore the capacity of these solid portions might be thus calculated. And we may here observe, that the same method is evidently applicable to masonry calculations, with even greater facility, as structures of masonry are usually composed of symmetrical solids.

The remarkable property of the prismoid, above alluded to, was established in connexion with prisms, pyramids, wedges, and frustra, of pyramids, by a simple inverse algebraic process, displaying the relation between the common rules, laid down by the writers on mensuration, and the prismoidal formula. But this formula, admits of a direct demonstration by the aid of the integral calculus, and of a more connected proof that it is the *fundamental rule* for the solidity of all right lined solids terminating in parallel planes.

As the paper on mensuration, before alluded to, relies upon the establishment of this property, it has occurred to the writer that it might be agreeable to some of the readers of this work, to have a direct development of the principles, which that essay reduces to practice; and with this view, I propose, first, to establish the truth of the prismoidal formula, and then to trace up the dependence upon it, of the ordinary rule for the mensuration of other solids.

General Demonstration of the Prismoidal Formula.

Fig. 1.

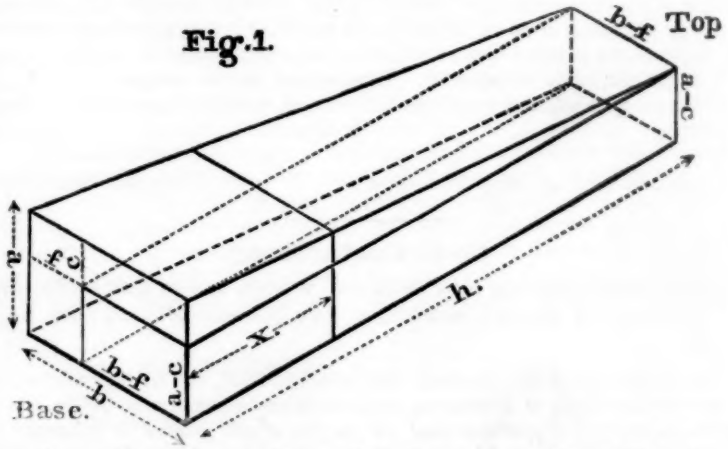
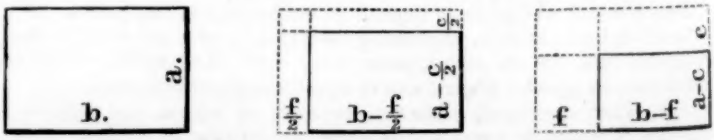


Fig. 2. Base=b. Fig. 3. Mid. Sec.=m. Fig. 4. Top=t.



Let fig. 1 represent a prismoid; fig. 2. the base; fig. 3 the mid section; and

fig. 4 the top. All the dimensions being designated, as marked upon the several figures.

The area of the base will be, (see fig. 2.)

$$a \times b = ab.$$

The area of the mid section will be, (see fig. 3.)

$$\left(b - \frac{f}{2}\right) \times \left(a - \frac{c}{2}\right)$$

$$= \left(\frac{2b - f}{2}\right) \times \left(\frac{2a - c}{2}\right)$$

$$= \frac{4ab - 2af - 2bc + fc.}{4}$$

Whence four times the mid section:

$$= 4ab - 2af - 2bc + fc.$$

The area of top will be, (see fig. 4.)

$$(b - f) \times (a - c.)$$

$$= ab - af - bc + fc.$$

Any transverse section of this prismoid, parallel to its base, or top, will be a rectangle.

The lengths of the sides forming the rectangle of the top, are supposed to be less than those of the base, which correspond to them by the quantities f and c, respectively. And it is evident from inspection, that the sides of the rectangular sections, proceeding from the base towards the top, *diminish* as the distance of the section from the base *increases*.

Let x, be the distance of any section from the base, supposing it, of course, to be parallel to the base or top, then the diminutions in the sides of this rectangle, will be to the total diminutions in the ratio of x to h, or as $\frac{x}{h}$.

Therefore, generally, the area of any rectangular section of a prismoid, at any distance, x from the base, will be

$$= \left(a - c\frac{x}{h}\right) \times \left(b - f\frac{x}{h}\right)$$

$$= \left(\frac{ah - cx}{h}\right) \times \left(\frac{bh - fx}{h}\right)$$

Whence expanding $= \left(\frac{abh^2 - bchx - afhx + fcx^2}{h^2}\right) =$ Area section.

Wherefore the element of solidity, or differential of the solid,

$$= \left(\frac{abh^2 - bchx - afhx + fcx^2}{h^2}\right) dx$$

Whence $\frac{abh^2dx}{h^2} - \frac{bchxdx}{h^2} - \frac{afhxdx}{h^2} + \frac{fcx^2dx}{h^2}$

The integral of which will represent the capacity of any frustrum of a prismoid, whose length $= x$.

$$\int \frac{abh^2dx}{h^2} - \int \frac{bchxdx}{h^2} - \int \frac{afhxdx}{h^2} + \int \frac{fcx^2dx}{h^2}$$

$$= \frac{abh^2x}{h^2} - \frac{bchx^2}{2h^2} - \frac{afhx^2}{2h^2} + \frac{fcx^3}{3h^2}$$

In point of fact, this integration produces a constant quantity, C, but as this = 0, when we estimate the capacity of the solid, from the base, as we propose to do, we may neglect it.

Reducing to a common denominator, we have, $\left\{ \frac{6\,abh^2x}{6h^2} - \frac{3\,bchx^2}{6h^2} - \frac{3\,afhx^2}{6h^2} + \frac{2\,fcx^3}{6h^2} \right.$

which is the general expression for the solidity of any frustrum of a prismoid, whose length measured from the base = x. Now to transform this expression, so as to apply to a whole prismoid, we must suppose $x = h$, and let s = solidity:

Then substituting h for x in the above expression we have, $\left\{ = \frac{6\,abh^3 - 3\,bch^3 - 3\,afh^3 + 2\,fch^3}{6h^2} \right.$

Or dividing by h^2 $\quad = (6ab - 3bc - 3af + 2fc) \times \frac{h}{6} = \mathrm{S}.$

Which expression may be transformed into the following,

$$\Big((ab - bc - af + fc) + (4ab - 2bc - 2af + fc) + (ab)\Big) \times \frac{1}{6}\,h = \mathrm{S}. \quad (\mathrm{A.})$$

We will call this equation A, and it is equivalent to

$$\Big(\text{(Area of top.)} + \text{(four times area mid. sec.)} + \text{(Area of base)}\Big) \times \frac{1}{6}h = \mathrm{S}.$$

See the areas of these sections as heretofore deduced. The above equation A, is in fact, the general formula.

$$(b + 4\,m + t) \times \frac{1}{6}\,h = \mathrm{S}.$$

at which we desired to arrive, and the truth of which is established by the foregoing investigation.

To trace up now the dependence of the usual rules for the capacity of certain solids, upon the general formula, it may be premised, that of all right lined solids, bounded laterally by longitudinal planes, and terminated in two transverse parallel planes, we distinguish but *four* independent species, viz:

1. Prisms, which, on account of the analogy subsisting between them, include cylinders.
2. Pyramids, which include cones, because cones, and pyramids of a common altitude, and equal bases, are equal.
3. Wedges.
4. Frustra of pyramids, which by analogy include frustra of cones.

To show that the general formula, is the *fundamental rule* for determining the solidity of these several solids, and by a necessary consequence, for the mensuration of any right lined solid whatever, made up of any combination of the four species, having *a common altitude*. We will take up,

1. *Prisms.*

These are in fact, prismoids, of which the end sections are equal and similar: and as all sections of a prism, parallel to the base, must be also equal and similar, therefore the sides of those sections do not diminish, and

f and c, the diminutions of the prismoid, when it becomes a prism, vanish. or become = O.

Substituting then in equation A, zero for f and c, we have,

$$\Big(\big(ab-(b\times o)-(a\times o)+(o\times o)\big)+\big(4ab-(2b\times o)-(2a\times o)+(o\times o)\big)\times(ab)\Big)\times\frac{1}{6}h=\mathrm{S}.$$

Which is equivalent to

$$\Big((ab)+(4ab)+(ab)\Big)\times\frac{1}{6}h=\mathrm{S}.$$

Whence, $(6ab)+\frac{1}{6}h=\mathrm{S}.$

Or, finally, $ab\times h=\mathrm{S}.$

which is the usual rule for finding the solidity of a prism, or cylinder.

2. *Pyramids.*

A pyramid may be considered as a prismoid, whose sides diminish by such a ratio, that if the solid were prolonged from the small end, the sides of the rectangular sections, would vanish at the same moment, or concur upon a point, (the vertex of the pyramid;) considering the prismoid at this instant, it is evident that the diminutions f and c, of the sides of the base, become equal to the sides themselves, and if the base of the pyramid be any rectangle $a\times b$, we must, therefore, in equation A, substitute a for c, and b for f; and we have,

$$\Big((ab-ba-ab+ba)+(4ab-2ba-2ab+ba)+(ab)\Big)\times\frac{1}{6}h=\mathrm{S}.$$

Whence $\Big((o)+(ab)+(ab)\Big)\times\frac{1}{6}h=\mathrm{S}.$

Or, $(2ab)\times\frac{1}{6}h=\mathrm{S}.$

Or, finally, $ab\times\frac{1}{3}h=\mathrm{S}.$

which is, in fact, the common rule laid down in the books, for finding the capacity of a pyramid, or cone.

3. *Wedges.*

If we imagine the sides of the successive sections of a rectangular prismoid, to diminish by such a ratio, that if the solid were prolonged from the small end, they would not all vanish at once; then it will be found that when one pair of sides of the rectangular section disappears, the other pair will coincide, and become a right line, the solid in point of fact, will run to an edge, and the prismoid will be transformed into a wedge. Let the base, or back, of any wedge, be any rectangle $a\times b$, and suppose in the prismoid fig. 1, the side a, to vanish, then it will become a wedge, of which—

$(b-f,)$ = the length of the wedge; a = breadth or thickness of the back; b = the length of the back. And as the side, a, is supposed to vanish, it will at the instant of disappearing, become equal to c, its diminution.

Substitute, therefore, in equation A, a for c, and we have,

$$\left((ab - ab - af + af) + (4ab - 2ab - 2af + af) + (ab)\right) \times \frac{1}{6} h = S.$$

Whence, $$(3ab - af) \times \frac{1}{6} h = S.$$

Or, finally, $$\left((b - f) + 2b\right) \times a \times \frac{1}{6} h = S.$$

But $(b - f)$ = "length of edge;" a = "breadth or thickness of back;" and $2b$ = "twice the length of the back."

Consequently, this expression is in fine, the common rule laid down, by writers on mensuration, for ascertaining the capacity of wedges.

4. *Frustra of Pyramids.*

We may regard these solids as prismoids, whose sides diminish by a regular proportion to their own lengths, such, that if the solid were prolonged from the small end, all the sides of the rectangular section, would vanish at once, and the solid become a pyramid. Therefore f and c, the total diminutions in the sides of the frustrum, or the quantities by which the sides of the top are less than those of the base, must have the same ratio as the sides themselves.

Or, $$f : c :: b : a.$$

Consequently, $$bc = af, \text{ and } f = \frac{bc}{a}$$

Now in equation A, substitute bc for af, and $\frac{bc}{a}$ for f, and we have,

$$\left((ab - bc - bc + \frac{bc^2}{a}) + (4ab - 2bc - 2bc + \frac{bc^2}{a}) + (ab)\right) \times \frac{1}{6} h = S$$

Whence, $$\left(6ab - 6bc + \frac{2bc^2}{a}\right) \times \frac{1}{6} h = S.$$

Or, $$\left(3ab - 3bc + \frac{bc^2}{a}\right) \times \frac{1}{3} h = S.$$

Which may be transformed into

$$\left((ab - 2bc + \frac{bc^2}{a}) + (ab - bc) + (ab)\right) \times \frac{1}{3} h = S.$$

But $\left(ab - 2bc + \frac{bc^2}{a}\right)$ is the area of the top, when the prismoid becomes a frustrum of a pyramid. And (ab) = area of base, whilst $(ab - bc) = \sqrt{ab \times \left(ab - 2bc + \frac{bc^2}{a}\right)}$ the square root of the product, of the end areas.

Wherefore, the above expression, is merely the usual rule for the capacity of frustra of pyramids, or cones, expressed in Algebraic language.

Besides the applications we have above given, of the prismoidal formula to the measure of solidity; it may be employed by simply substituting lines for surfaces, in the measurement of the superficies of triangles, parallelograms, and trapezoids.

For a triangle may be regarded as a rectangular pyramid, of which one side of the base equals zero.

A parallelogram, as a rectangular prism, without thickness.

And a trapesoid, as a wedge on a rectangular back, the side of which is perpendicular to the direction of the edge, or in fact, the thickness of the back = O.

The prolific formula, of which we have been treating, has also, some other applications in mensuration, such as to determine the solidity of an Hemisphere, and by a slight transformation, to calculate the surfaces of several bodies. But as all these are foreign to the present purpose, the writer does not propose to engage in their discussion.

Oldtown, Md., May 25th, 1840.

Physical Science.

Observations on the Tornado which desolated Natchez, on the 7th of May, 1840. By H. Tooley.

The atmospheric temperature, from the first to the sixth day of May, was higher than on the same days of the five preceding years. The range of the Thermometer and Barometer of the days mentioned, together with the winds and weather, will be seen in the following table.

Table.

Days.	THERMOMETER.			BAROMETER.			ATT. THERMOM.			WIND. DIRECTION AND FORCE.
	6, A. M.	12, M.	6, P. M.	6, A. M.	12, M.	6, P. M.	6, A. M.	12, M.	6, P. M.	
1	75	79	82	29,77	29,77	29,74	78	79	82	w 3 2, n e 2
2	75	82	85	,69	,67	,58	77	81	82	s 2, sw 3 4 5
3	76	83	85	,51	,52	,52	78	83	84	s w 4 5 3
4	70	82	86	,64	,73	,70	74	85	85	s 2, n 2, n e 2
5	69	79	86	,72	,71	,63	73	79	83	e 3, w 2, n e 2
6	71	83	85	,60	,53	,45	75	81	83	s e 2, s 3 4 5
Mean,	72,6	81,3	84,8	29,65,5	29,65,5	29,60,3	75,8	81	83,3	
7	73	80		29,46	29,49		80	80		

Remarks on each day.—1. Darkly overcast all day, and very hazy. 2. Overcast, very hazy; dense cumuli, cirri of every form, windy all night. 3. Large cumuli, under scud 5, thunder, dense cumuli; the evening closes very hazy, but cloudless. 4. Morning clouds, a few cirri, the sun sets brilliantly. 5. Cirri—without a cloud—thin cirri—overcast. 6. Overcast all day, sprinkle of rain.

The seventh day was ushered in densely overcast, and very warm, with a brisk wind at S. 4, increasing at noon, and veering to the E. 5. At meridian, the south-western sky assumed a darker and more tempestuous aspect, and gloom and turbulence increasing every moment. At 12.45 the roar of the approaching storm began to be distinctly heard, the wind blowing a gale, N. E. S. The roar and commotion of the storm, grew more loud and terrific, attended with incessant corruscations and flashes of forked lightning. As the storm approached nearer, the wind veered to the

E. 7. At 1.45 the storm cloud assumed an almost pitchy darkness, curling, rushing, roaring above, below a lurid yellow, dashing upward, and rapidly approaching, striking the Mississippi some six or seven miles below the city, spreading desolation upon each side, the western side being the centre of the annulus. At this time the blackness of darkness overspread the heavens, and when the annulus approached the city, the wind suddenly veered to the S. E. S. attended with such crashing thunder, as shook the solid earth. At two the tornado 10, burst upon the city, dashing diagonally through it, attended with such murky darkness, roaring and crashing, that the citizens saw not, heard not, knew not the wide-wasting destruction around them. The rush of the tornado over the city, occupied a space of time not exceeding five minutes, the destructive blast not more than a few seconds. At this moment the barometer fell to 29.37.

The storm passed over, a comparative calm ensues. The affrighted and terror smitten inhabitants arouse from their stupor, breathe more freely, and see around them an appalling spectacle. Every building in the city more or less injured, many utterly demolished, and very many unroofed, with their walls more or less broken and thrown down; every tree and fence prostrated, and the street filled with scattered fragments of every kind, and nearly impassable.

The tornado, in its course, passed over Natchez under the hill, and swept it with the besom of destruction, overthrowing, crashing and demolishing almost every house, shop, and building, and at one fell swoop reduced that part of the city to undistinguished ruin. Three steamboats broke from their mooring; their upper works are blown off as feathers; two of them capsize and sink, and nearly all their crews and passengers perish in the storm river flood. More than sixty flat-boats, laden with up country produce, break from their fastenings, and with their crews disappear.

The tornado in its course from the south-west, passed centrally through the plantation of Walton Smith, Esq., on the western side of the Mississippi, seven miles below Natchez, devastating every thing in its passage; thence up the river, the centre of the annulus being on the western side, and in its passage spread destruction on the plantations and forests for half a mile in width, westwardly, and left the western bank at the bend above Natchez, crossing above and continuing its devastating course to the northeast. Opposite Natchez, the centre of the annulus was in the river on the western side, the river being about six-tenths of a mile wide. The wind that desolated Natchez, was from the southeast, blowing inward to the annulus, and onward, forming a curve as it touched the annulus.

In the course of the tornado over the city, in hundreds of instances, proof irresistable was shown, that in the rush of the storm over a house, the external atmospheric pressure was so taken off that the atmosphere within the house suddenly expanded, so as to force an outlet, either by blowing off the roof, bursting open doors and windows, driving outward gable ends, or the whole or parts of walls; on the contrary, where leeward doors, or windows, or the trap doors of roofs were open, no such destructive effects were produced. For proof of this one meteorological fact, the following cases out of very many, will suffice.

1. The garret of a brick house occupied by Thomas Armat, Esq., as an office, was closely shut up, both ends burst outward, and such was the force of the explosive power, that some of the bricks of the windward end, were thrown upon a terrace nearly on a level with the end, and at a distance of not less than twenty feet, in the face of the storm.

2. A brick house on the north side of Main street, belonging to John Fletcher, had the leeward gable end thrown out, the windward end remaining uninjured.

3. The windward gable end of a large house adjoining the Commercial Bank, burst outward against the face of the storm, the leeward end was uninjured.

4. The gable ends of a large three story brick house, on Franklin street, owned by Rowan and Cartwright, were thrown outward with great force.

5. The front ends (leeward to the storm,) of two brick stores, owned by Eli Montgomery, were thrown outward with great force, the windward ends being uninjured.

6. Another large brick house, near the last just mentioned, owned by Watt, Burke & Co. had the leeward side nearly demolished.

7. Another brick house adjoining the last mentioned had the windward gable end thrown outward.

8. The roof of the Theatre, a large brick building, had the entire roof blown off and thrown some ten feet forward, and the walls demolished.

9. The leeward walls of two front rooms of the Tremont House, on Wall street, were thrown outward with great force, without destroying or moving the furniture therein, and where the storm could have no access.

10. The roof of the fire-proof brick office of the Probate Court, exploded to windward, that side, it is presumed, being the weakest.

11. The gable ends of a large brick store on Main and Pearl streets, were thrown outward with great force.

12. The southern side, and the northern and western gable ends of the brick Insurance buildings, on Pearl and Market streets, were thrown outward with such force, as to nearly demolish the building.

13. The roof of Doctor Merrill's house on State street, was saved by the explosive power bursting open a large trap door in the roof, thereby making an outlet for the expanded air.

14. The leeward wall of a new wooden house, owned by Rhasa Parker, on Washington street, was thrown outward by the explosive power, the windward side and end remaining unbroken, excepting the glass of the windows. Hundreds of facts, if need be, might be adduced to prove that when there were no sufficient openings, to let out the expanded air, the roof, or some other part of the house gave way, most generally the leeward.

The quantity of rain that fell, during the passage of the tornado, over the city was only 0·83 of an inch, holding in suspension so much mud and minute particles of leaves and other vegetable matter, as to be impervious to sight, and leaving a thick coating upon whatsoever it came in contact.

This brief account of the tornado, will be closed by presenting to those who are skilled in the physiology of plants, for further investigation, the following facts.

The effects of the storm upon the leaves, and buds of plants, was in a manner to sear them, abstracting or destroying so much of their vitality, that such as did not die outright, were crisped, and their growth so suspended, that it was for ten or more days, before they resuscitated, and began again to grow. Some very thriving grape cuttings, in the garden of the writer of this paper, were killed, and the old vines stunted. Even the leaves of the succulent Morus Multicaulis, appeared as if an eastern sirocco had passed over them. A luxuriant arbor vita in the writer's yard, appears blighted and dying. Fruit trees, and grass, and weeds, put on the same appearance.

Southwick, Massachusetts, June 16th, 1840.

Observations on the Auroral Arch seen on the 29th of May, 1840. *By* A. Holcomb.

Dear Sir,—Agreeably to your request, I send you an account of the observations I made at the time of the auroral arch, seen on the evening of May 29th, 1840. There were some unusual appearances before 9 o'clock, in the neighborhood, or near where the arch afterwards appeared. A light streak resembling the sun shining on a cloud, was seen in the east, running N. E. and S. W. Another was seen in the south. No very special notice, however, was taken of them at the time. I was observing double stars that evening most of the time, but was not observing at the moment the arch commenced. I first saw it at 9h. 15m., it might have commenced five minutes sooner. At 9h. 20m. it passed over ι Bootes, and μ Leonis, or point of the sickle, and about one degree south of the Beehive, in Cancer.

It did not extend at any time, but a few degrees west of the Beehive, not reaching to the western horizon. It was the most brilliant at about 9h. 25m. At 9h. 30m. it began to be irregular, with many brilliant spots, like the setting sun shining on curdled clouds. At this time also, it began to be double through a considerable portion of its length, (that is) from Arcturus to Leo. At 9h. 35m., it passed over Arcturus and Regulus. At this time waves resembling fog, driven by wind, were seen commencing near Arcturus, and running rapidly to the west. At 9h. 40m. it wholly disappeared. Many shooting stars appeared in the neighborhood of the arch, during its continuance. Very light in the north, both before the arch appeared, and afterwards. The arch was not at right angles, with the magnetic meridian, the eastern part being farther south than the western. This arch strongly resembled that of May 8th, 1836, with this difference, however, that of 1836 varied more from the magnetic east and west, than that of 1840. The eastern portion of the former, (before it disappeared,) passed six degrees south of Arcturus, whereas the western part passed between Regulus and Gamma Leonis. That of 1836 when it first appeared, passed over ι Bootes at 9h. 30m., which varied only ten minutes from the time of the present one, passing over the same star.

I think you informed me that it was not seen in Philadelphia, until after 10 o'clock. This is somewhat strange, for what should have rendered it invisible? Was it too low to be seen? Or not in a right position with respect to the eye? Was the same arch, when diminishing in splendor here, increasing in splendor farther south? It certainly had the appearance of becoming extinct, not merely of passing out of sight. It is probable that a different arch was seen in Philadelphia, from the one seen here, and also, probable that these auroral arches, are not so high as some here supposed them to be. You will be puzzled, I think, to ascertain the height of the present one, from the observations here, and at Philadelphia. I have no account of observations made at other places.

Yours, &c. Amasa Holcomb.

Sears C. Walker, Esq.

Notice of a few of the subjects contained in Poggendorf's Annals for 1840.

By J. C. Booth.

Several subjects of great interest both with reference to Chemistry and Physics are to be found in the "Annalen" for the present year, four numbers of which having been received, we hasten to lay a sketch of them before the readers of the Journal. C. Kersten has proved the existence of a lower oxide of titanium, than that generally known as titanic acid, it having been supposedto exist from analogy and from the discovery of a protochloride. It may be obtained by fusing titanic acid, and bi-phosphate of soda in a platinum crucible, transferring the mass to a green glass tube, and while heated intensely, passing dry hydrogen over it. By dissolving the salt in water, protoxide of titanium remains of a beautiful lavender-blue color. From observation, he was led to the supposition, that the blue color of slags from an iron-furnace, was due to the presence of this oxide, since titanic acid is frequently found in iron ores, and might be reduced by intensely fused cast-iron; and by experimenting with the substances of slags, chemically pure, he obtained a similar blue compound, proving the correctness of his supposition. He farther proposes its employment as a blue color, for porcelain, for which purpose it is little inferior to cobalt. Poggendorf remarks on the above, that Berthier in his late work attributed the color of the slag from alais, to titanium.

Several mineral analyses are described, the results of which are the following. V. Ewreinoff analyzed Heterokline from Piedmont, and found it to consist of five parts of oxide of manganese and one of silica. Formula $5\,Mn^2\,0^3 + Si\,0^3$.

Th. Scheerer has shown by thirteen analyses, that nepheline, elæolite, and cancrinite, are identical, and that the formula for this genus of minerals, is three atoms of silica, two of alumina, and two of alcali, (potassa and soda,) which may be thus expressed:

$$\left.\begin{matrix}(Na\,0)^2\\(Ka\,0)^2\end{matrix}\right\} Si\,0^3 + 2(Al^2\,0^3 + Si\,0^3).$$

Dr. Petrina, of Linz, described a Kaleidopolaroscope, which, he observes, produces figures of extraordinary beauty, and is at the same time a very delicate test for polarized light. To make this instrument, one of Nichol's prisms of double-spar is placed in the opening of a common kaleidoscope, to which the eye of the observer is applied. Instead of the usual colored articles, which are placed at the other end, between two thin glass plates, he employed foliæ of (gypsum) selenite, of different forms and thickness.

An additional series of "Poggendorf's Annalen," has been commenced, comprising articles on Physics and Chemistry, which have appeared in other countries, and on reviewing the two numbers we have received the present year, we are pleased to find translations of Dr. Henry's treatise on electro-dynamic induction, and Prof. A. D. Bache's essay on "the influence of wind on the quantity of rain obtained in rain gauges." There is also an extract from Dr. Julius' work, on the "state of morals and manners in the United States," relative to the former saline nature of our northern lakes. This work, containing the views of Dr. Julius, deduced from personal observation, during the years 1834—5 and 6, should be translated, not merely because it embodies his views, relative to our morals and manners, but also, contains much information, that would be interesting in a scientific light.

Franklin Institute.

Conversation Meeting.

The ninth Conversation Meeting of the season was held at the Hall of the Institute on Thursday evening, May 28th, 1840. The concourse of members was large, and the advantage of such meetings, for purposes of scientific and technical communication, was fully illustrated on this occasion.

Among the interesting objects presented for exhibition was a native *Magnet*, or loadstone, one of the largest probably that has ever been mounted, weighing not less than 34 lbs., and possessing considerable power. It was deposited by Mr. Schnaitmann, 206 north Second street, and is offered for sale. It is said to have been brought from Australia.

A patent *Water and Provision Cooler* was left for exhibition by Mr. David Evans, No. 76 south Second street, and is regarded as possessing some peculiar advantages. It is of a cylindrical form, and contains a filter, of the kind constructed by Mr. Sanderson, by means of which cold and pure water is drawn from a stopcock at the side, while sufficient space is reserved for provisions and ice within. It has been mentioned that the zinc lining of refrigerators is liable to oxidyze, especially by the presence of acids or acidifiable substances. The remedies suggested, if any be needed, are the application of paint, or the substitution of lead, which, however, should not come in contact with articles of food.

Messrs. Carr and Keim, 33 Commerce street, deposited several interesting articles of hardware and ironware, as specimens of their stock. Among them was *Morrison's Counter-scale*, differing from that of Fairbanks in having the weights applied at the end of the beam; while it possesses the compactness of the latter, so desirable for grocers and others who employ small weights. Also *Ship Spikes* from the Albany Iron Works at Troy, N. Y., called hammered spikes in contra distinction from the pressed spikes of Burden; and another specimen of the same *coated* with a metallic composition, by a new process invented by Mr. Loring of Philadelphia, to act galvanically in protecting them from oxidation. Also andirons coated in the same manner, and a variety of plates, kettles, bakers, &c., from the Hollow Ware Foundry of Savary & Co., Front street below Reed. Also friction rollers of superior quality, and a variety of patterns of door latches, partly of cast and partly of wrought iron, made by Parker and White, of Meriden, Conn. A fine specimen of English and Huber's coffee mills was exhibited by Mr. Zell, 298 Market street, who has them for sale.

The entertainment of the evening was greatly enhanced by an address from Dr. Hare, concerning some interesting experiments recently made by him, relating to Caloric and Meteorology. It has been generally supposed, that the cloudiness which appears within the cavity of a receiver rapidly undergoing exhaustion indicates that an increase of humidity is a consequence of rarefaction. Dr. Hare has ascertained, by means of a delicate hygrometer, that dryness ensues in proportion to the extent of the exhaustion. In fact, under these circumstances the space from which the air is withdrawn, takes up moisture in order to replace the aqueous vapour which being associated with the air is removed with it to a commensurate degree.

It is well known that the cavity of any vessel having access to moisture

will become replete with aqueous vapour of a tension corresponding with the temperature, uninfluenced by the density of the contained air, so that the quantity is ultimately uninfluenced by rarefaction of the air. Dr. Hare finds that if air saturated with water be allowed to enter a cavity so supplied with vapour, there will be an excess of moisture which will, consequently, by precipitation, form a cloud, and finally appear in drops like those of dew or rain upon the interior surface of the vessel. Meanwhile the temperature rises and the hygrometer indicates excessive humidity.

Dr. Hare ascribes the upward motion, observed within the sphere of tornadoes or hurricanes, to electrical discharges between the terrestrial surface and the thunder clouds, and surmises that in some cases such discharges may take place in order to establish an equilibrium between the earth and the conducting concentric space beyond the elevation at which the atmosphere is sufficiently dense for electrical insulation.

An interesting specimen of the granular ore of Platinum, consisting of some grains of unusual size, some of which were worn into the shape of pebbles, was exhibited by Dr. Hare. Also some very handsome globules of Potassium, being a part of an aggregate of more than six ounces, obtained at one operation by a process, of which an account was published in the latest volume of the American Philosophical Transactions.

There was also exhibited some copies of medals, formed by galvanic action, by Mr. C. Sheble; and some fine heliographic or photographic portraits taken at the establishment of Mr. R. Cornelius, in Eighth street near Chesnut.

On the whole, the interest of this meeting was well sustained, evincing the constant attention paid by the active members of the Institute to the advancement both of physical science and the mechanic arts.

Committee on Science and the Arts.

Report on the Substitution of Lime for Salt in Preserving Ships.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination the propriety of the Substitution of Lime for Salt, as a preservative for Ships: Report—

That they are called upon to regret that only a few facts could be brought to bear upon the question, and that the experience of others, as ascertained by an examination of approved works on the preservation of timber, is so limited, as not to permit of their giving a decided answer relative to the beneficial or the injurious effects of lime when used in the manner proposed. The effect of strong caustic alkali upon wood has been a subject of experiment, and resulted in the complete destruction or solution of the ligneous matter;* but it has been applied in a more diluted state with advantage, to remove and prevent the formation of fungus. The effects produced on vats in which caustic lye is made for domestic purposes, are to soften the texture of the wood in such a manner that the surface and even the interior to a short depth, may be pealed off in long and slender fibres when moist, or in shorter fibres when dry. There are no evidences of decay similar to that arising from rot, but it seems as if the substance cementing the fibres was removed by the alkali, while they are not influenced by it. This wood when dry is more flexible and less elastic, and its surface at least appears

* Ure's Dictionary, Art. Wood.

to be much lighter from the removal of a portion of matter. It has consequently a diminished hardness.

From the alkaline properties of lime we might infer a similarity in its action to Potassa; an inference confirmed by observation. Wood covered or coated with lime in a moist or dry situation undergoes a similar change externally. There is no appearance of decay, but the fibres may be pealed off, the surface is lighter, softer, more flexible and less elastic. These effects then are similar to those above noticed excepting that they are exhibited in a diminished degree, for the action does not take place to the same depth, nor can the external fibres be removed with the same readiness. When in contact with alkaline substance, the wood does not appear to undergo farther change than that which has been described, but if the contact were broken, there can be little doubt that it might be more readily injured by rot, from the softness of texture it has acquired, unless indeed it has become so impregnated as to obviate decomposing influences. The employment of lime, therefore, may be recommended as a preservative of timber, an opinion strengthened by the experience of ages.

But again, it becomes a question of importance to determine the state of the lime most favourable to its powers of preservation, for it is asserted that where wood remains a length of time in contact with quick lime and water, it suffers a more rapid decomposition than under ordinary circumstances. On the other hand, where wood is frequently washed with a coating of lime suffering a short space of time to elapse between the several applications, the wood is not only perfectly preserved, but often becomes so hard as to blunt the teeth of a saw. In this case, it has become partially carbonated, including even that portion which has penetrated the wood. It would therefore appear to be more advisable, if lime should be substituted for salt in the case proposed, to employ it in a partially carbonated state, which may be attained by slaking quick-lime with a quantity of water, just sufficient to convert it into fine powder and then spreading it on any convenient surface for several weeks prior to its application, in order that it may absorb carbonic acid from the atmosphere.

But in the case referred to, there can be no doubt that a portion of the lime will be in contact with salt water. Can any injurious effect arise from this circumstance? The committee are of opinion that it cannot; for although a portion might be converted into muriate of lime under certain circumstances, the probability is that that portion would be small and not capable of materially affecting the wood, even supposing it should do so injuriously, which the committee have no ground for believing.

Again, to an objection proposed, that lime might generate heat, it may be answered, that lime is known to combine with only one atom or 24 per cent. water, forming the hydrate of lime (slaked lime), and that only during its combination does it evolve caloric; and since it is proposed to employ it in a slaked condition, this objection may be unhesitatingly set aside.

The presence of muriate of magnesia, in common salt, which is the material ordinarily employed for filling the spaces in the sides of a ship, by its strong affinity for water tends to keep the salt constantly in a moistened state and probably communicates no inconsiderable quantity of dampness to the vessel. It is highly probable that the lime would obviate this difficulty from its drying quality. The purifying effects of lime are also well known, and it is not an uncommon practice in the warmer climates of Europe to wash the interior of a ship to prevent and free it from contagion.

To compare the two substances together, it may be stated that salt hard-

ens, while lime rather softens the external parts of wood where they are in contact with it, while both tend to prevent the rot, or the attack of insects; that the salt probably tends to keep the atmosphere of a vessel damp, which lime would not;—that the lime will tend more to purify the air than the salt; —that lime has a less specific gravity than salt and is to be preferred on that account.

The committee, therefore, can perceive no ground of objection to the substitution of slacked lime for salt, for filling the interstices of the sides of a ship, particularly if employed in a partially carbonated state; while at the same time where so much interest is at stake in answering the question, the limited information on the subject which they possess will not allow them to give a decided opinion. In conclusion, they would request those who have observed facts, or acquired information, relative to effects of lime on wood under any circumstances, to communicate them to the Institute, in order that they may be brought before the public.

By order of the Committee.

WILLIAM HAMILTON, Actuary.

Philadelphia, June 11th, 1840.

Mechanics' Register.

LIST OF AMERICAN PATENTS WHICH ISSUED IN MAY, 1839,

With Remarks and Exemplifications by the Editor.

1. For making the *Joints of Stone Pumps;* Abraham Van Voorhes, Hebardsville, Athens county, Ohio, May 3.

The sections of these pumps are to be made of convenient lengths, and they are to be formed with stout flanches at their ends, forming shoulders, by the aid of which, and of iron rings and screw bolts, they may be drawn together. A circular groove is to be made upon the faces of the joints, and oakum, or tarred rope, inserted, to make them air tight; the claims are to "the manner of making the joint air tight by the application and use of the groove and band, and oakum, or tarred rope, in the stone pump, in the manner described."

2. For an improved *Auger for Boring Earth;* George Page, city of Baltimore, May 3.

This auger is intended, principally, for boring post holes in clayey and other soils adapted thereto, and is similar in its general construction to such as were long since patented and used for that purpose. "The peculiar features of this auger consist in surrounding the cutting apparatus with a rim, and dispensing with the centre piece, or twist, of the common auger." To this rim the cutters are secured by means of screws, and the claim is to this peculiarity of construction.

3. For improvements in *Fire Arms;* Nathan Starr, Middletown, Middlesex county, Connecticut, May 3.

This gun is of the kind that have a single movable chamber which is raised on a pivot at its rear end to receive the charge, and is then forced down in a line with the barrel, and caused, by an excentric, to enter the rear end of

the barrel to a small distance, a fillet being formed on it for that purpose. The claims made are to the particular arrangement of the parts for effecting this purpose, and there is also a claim to the using the ram-rod, as a bayonet, one end of it being made pointed with that view, and provision being made for fixing it to the gun. The parts described and claimed as new do not present any thing worthy of particular notice, as being superior to others previously made for the same purpose.

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4. For a machine for *Cutting Staves, Slats, Laths, &c.;* Hardin Branch, city of New York, May 3.

This machine consists of a wheel which is to revolve, and has knives on its face for cutting thin pieces of wood, from blocks, strips, or bolts, operating precisely in the manner of other known machines. The patentee says that, "having given a description of the machine to which I apply my invention, I do hereby declare that I do not claim any part of said machine as of my invention; but what is claimed as new, and desired to be secured by letters patent, consists in the employment of the cast iron stocks constructed as described, for holding and securing the cutting tools to the wheel, for cutting thin pieces of wood from solid blocks." The cast iron stocks, so called for holding the cutters, are undoubtedly good things, but there is very little of novelty in them, as they consist merely of iron bed plates to which the cutters are attached by screws, in the common mode of managing such matters. The patentee has no ground to complain of the want of a liberal disposition in the office, so far as concerns the case before us.

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5. For a machine for *Raising Canal Boats, for repair;* N. N. Penrose, and S. F. Palmer, Beaver Meadows, Luzerne county, Pennsylvania, May 11.

"The nature of our invention consists in raising a boat in a swinging position, by means of levers, or balance beams, connected to frames which may be easily changed from one position to another, which is frequently necessary to work under the bottom of a vessel." The boat is to be raised by means of levers, to the short arms of which are attached frames of sufficient size to surround the boat, and these are to be let down into the water, so that the boat may enter them. To the long ends of the levers a box, or trunk, is attached, into which water may be poured, so as to raise and balance the boat. The levers are sustained on stout stone posts, which have their fulcra placed upon them.

The claims are to "the mode of raising and suspending boats for repair by vibrating lever frames, combined with longitudinal and transverse frames attached to the ends thereof; one set of transverse frames at the short ends of the lever frames containing the vessel to be raised, another set of transverse frames at the long ends of the lever frames suspending a trunk of water for balancing the boat."

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6. For an improvement in *Steam Boiler Furnaces;* Lucien Maillard, city of New York, May 18.

This improvement it is said, "will give an economy of more than one-third of the consumption of fuel, by the combustion of *dead steam.*" A gift, certainly, of no small importance. By *dead steam,* is meant that which has performed its office in the cylinder, and this is conducted through suitable tubes into hollow grate bars, under the furnaces of high pressure boilers,

whether of locomotive or other steam engines. From the hollow bars the steam is to enter the fire through numerous holes in them, made for that purpose.

Claim.—"I do not claim as my invention the introduction of waste steam into, or amidst, the red hot incandescent coals in the furnace for the purpose of increasing combustion by its decomposition, this having been previously done, but not in the manner in which I effect it. I therefore claim as my invention and desire to secure by letters patent, the introduction of waste steam on, or amidst, the red hot incandescent coals, by means of the arrangement of conical tubes, and hollow perforated bars, on which the coals rest, in the manner described."

There are several grave questions connected with the invention that is the subject of this patent, which we have not time to discuss, but which we will not entirely dismiss. To the theory that the water is decomposed, and aids the combustion in consequence of this decomposition, we have not yet, and do not now, give our assent; but this is a matter of no importance practically, provided the combustion be actually rendered more efficient by its agency, which we do not dispute. Steam, and water, have been carried into hollow perforated bars, with the same view as that above declared, but, so far as we are informed, the plan has been universally abandoned. The bars must, necessarily, when in contact with the fire, be frequently out of order. In locomotive engines the waste steam is wanted to increase the draught in the chimney, and if diverted from this object, and applied elsewhere, a balance of accounts will have to be struck, and this, we apprehend, would be against the sending the waste steam into hollow bars, so far as locomotives are concerned.

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7. For improvement in *Rail Road Cars;* Lewis J. Germain, Cattskill, Green county, New York, May 7.

The patentee has represented a six wheeled car, having a separate frame for each pair of wheels, and these frames operating upon each other, by means of a toothed segment and rack, or by means of jointed cross bars, on the middles of their sides of contact, these devices being substantially the same with others heretofore adopted. The middle frame of the three which sustains the axles, is so connected with the general car body frame above them, as to allow a certain degree of vertical play to it, for the purpose of equalizing the bearing of the wheels on the rails; this is effected by means of what are called stands and slides. The wheels are thus to adapt themselves to the curvatures of the road, and to its horizontal deviations. The claims are to the stands and slides in combination with the middle, and top, or body frame, in the manner described; and to the manner of connecting the three axle frames together, by a single or double cross joint, or a rack and segment wheel. The actual novelty of the devices here patented is but small, and we do not see any thing in them to justify high anticipations of their utility.

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8. For an improved *Jack Screw;* Stephen Vail, Speedwell Iron Works, Morris county, New Jersey, May 7.

This jack screw is intended principally for the purpose of lifting locomotives and cars on to the track of a rail road, and to this purpose it appears to be peculiarly well adapted; and it is, of course, also adapted to the raising of heavy bodies of other kinds.

The main lifting screw works through a nut, the standard, or lower

part of which is bifurcated, or divided into two legs, which rest upon a suitable base, to which they are hinged, so as to admit of the head of the main screw being thrown over, its shaft standing out of the perpendicular. The head of this screw has a collar round it within which it can turn, and to this collar is hinged the head of a second screw, which stands at an angle of about 45° with the first, and, like it, has a nut with bifurcated legs, hinged to the same base with the former. The two screws, and base, constitute a right-angled triangle when the main screw stands in a vertical position. It will be evident that by the action of these screws a heavy body may be raised, and moved over laterally, as may be required. The claim is to "the combining together the two screws in the manner above set forth; that is to say, by giving to their standards a hinge motion on the platform or base of the apparatus, and by connecting them to each other at their upper ends by a joint, whilst they are allowed to turn freely by the arrangement of the collars and swivels, or by some analogous contrivance; by which arrangement the locomotive, or other heavy body, to be raised, may be first lifted vertically, and then moved laterally; for the purpose, and substantially in the manner, set forth."

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9. For *Earthen or Cement Pipes, for conveying water*; Charles Stearns, Springfield, Hampden county, Massachusetts, May 8.

These pipes, or trunks, for the conveyance of water, &c., are to be made of flat rectangular pieces of earthen ware, properly baked, and having holes in the upper and lower pieces for the insertion of screw bolts, to hold them together. The side pieces are to enter channels provided in the top and bottom pieces for that purpose. The parts are to be put together with cement between the joints. "The invention claimed consists in the before described mode of making pipes, or conduits for conveying water, &c.; that is to say, with rectangular pieces of burnt clay, channeled on each side of their inner surface to receive the pieces forming the sides of the tube; and also the method of fastening them together with bolts, all substantially as above described."

These trunks are, of course, intended to bear a pressure of water, and are to be substituted for pipes of wood and iron, but as they are made of brittle materials, entirely unyielding, they will be liable to fracture should there be the most trifling settling of the ground in which they are laid; an event which it is scarcely possible to guard against, although the utmost care and skill may be employed; we are very apprehensive, therefore, that the proposed plan, if tried, will be soon abandoned. Besides this objection, it will be found to be a thing of extreme difficulty to join the respective pieces together so that they shall be water tight.

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10. For an improvement in *Applying Heated Air to Furnaces, Economizing fuel and consuming Smoke*; Frederick P. Dimpfel, city of New York, May 9.

By the improvements in the supplying of heated air to furnaces which form the subject matter of this patent, we are informed that "a great saving is effected in the quantity of fuel employed; the smoke and combustible gases which ordinarily escape combustion are wholly or in great part consumed, and the sparks given off by the fuel are arrested."

A good general idea of the construction of the apparatus may be obtained from the claim, which is as follows, "What I claim as my invention,

and desire to secure by letters patent, in the above described apparatus, is the employment of a box, or receptacle, constructed in the manner set forth, and which is to contain a stratum of pebble stones, or of any other material which will leave interstices through which air may be forced to pass, but which will have the effect of producing pressure within the furnace, which is supplied with air from a suitable blowing apparatus, and in which furnace the air is to be forced into a closed ash pit, the whole being combined and arranged substantially in the manner set forth.

"I also claim the mode described of forcing in with the atmospheric air a portion of that which has previously passed through the fire; by which means it is made to enter in consequence of the pressure to which it is subjected. I claim, likewise, the manner of shutting off the draught from the blowing apparatus, by the opening of the door for feeding the fire, as set forth."

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11. For an improvement in the *Blacksmiths' Tuyere Iron*; John Shugert, Elizabeth, Allegheny county, Pennsylvania, May 9, Antidated December 21st, 1838.

The patentee says, that "the improvement which I am about to describe, is on the tew-iron, for which I obtained letters patent of the United States, dated the thirty first day of March, 1836, in which the blast from the tew-iron entered the fire at an inclination, say of 45°. This elevation of the blast was found to produce beneficial results; but some inconvenience was experienced from the tendency of the coal to rise, or fly up, when the blast was given with considerable force, through a round nozzle; an inconvenience which is effectually removed by my present improvement, which is productive also, of other advantages." This improved plan consists in making the opening in the forge back oblong, instead of round; say from two to four inches in length, and from three eighths of an inch to an inch in height; the tube leading to this opening, is to assume the proper form as it approaches it, and it may be divided horizontally, by one or more partitions, which will prevent the falling in of coal, through the openings. The claim is to the oblong form given to the openings, in combination with the elevated blast.

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12. For an improvement in the *Fire Engine;* John Williams, Jr., Salem, Washington county, New York, May 11.

"The nature of my invention, consists in applying the power of the firemen, directly on the piston of a fire engine, without the intervention of levers, or breaks, which are commonly used for that purpose." The manner of effecting this object, is so clearly set forth in the claim, that no further description of it, appears to be necessary; this is to "the having a vertical cylinder in the centre of the body, or box thereof, with arms duly braced, projecting radially from the piston rod, with the outer ends attached to a hoop, or merely extending out, so as to be grasped by the hands; by which arrangement the engine is rendered so compact as to adapt it to steam boats, and to other situations, where economy of room is important, whilst at the same time, a sufficient power can be applied to it, to render it an efficient instrument."

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13. For an improvement in the *Machine for Drilling Rock;* Isaac H. Singer, Lockport, Will county, Illinois, May 16.

Several machines have been patented for the drilling of stone, but they

have, so far as we have heard the results, proved to be failures. The general object of these machines, is to facilitate the manner of working the drill up and down. The machine before us, has considerable complexity, and the references made to the drawings, are numerous, but the claims are limited to the combination of the frame in which the drill works, with the frame of the driving power, by means of an arm, as described. The drill stock, the jaws, and a pin, constructed and combined as set forth; and the peculiar form of the drill, or cutting portion. This peculiar form of the drill is thus described: "It is formed with two broad ends, or transverse cutting edges, with the bottom cutting edge, formed obliquely, from one of the broad ends to the other, these broad, or transverse, ends, are formed circular, corresponding with the circumference of the hole." The face of the drill, in fact, bears some resemblance to the letter N; a shape which it will be no easy matter to sharpen, although this has to be very frequently done.

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14. For an improvement in the construction of *Presses;* John J. Wise, city of Baltimore, Maryland, May 16.

There appears to be considerable novelty in this press, but we are very apprehensive that its merit will consist more in this than in its special adaptation, to the purpose of pressing. Its operation is like that of the screw press, but it is without a screw, the office performed by the thread and nut, in that power, being effected by inclined planes, formed on the transverse sections of a divided shaft.

There are two followers which are connected to the cheeks of the press by palls, or catches, said cheeks being notched for that purpose. The lower follower is to press the goods, and between the two is a vertical cylindrical shaft, divided transversely, and having its upper portion fastened to the upper follower, whilst the lower portion which is pointed, or formed conically, at its lower end, bears on the lower follower. The section of the shaft, is divided into three equal inclined planes, having vertical offsets at their terminations; and when the lower portion of the shaft is turned by means of a lever, one third of a circle, the lower follower will be forced down to a distance, equal to that of the obliquity of the planes, and the palls will catch upon the cheeks; when the planes are so turned, that their vertical offsets coincide, the upper follower will then fall, and its palls engage with the cheeks; when the operation is to be repeated. Friction rollers, or balls, it is said, may be interposed between the inclined planes. We shall not repeat the form of the claim, as it is to the peculiar mode of construction, above pointed out.

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15. For a *Thrashing Machine;* Jeremiah Wrighton, Tobacco-stick, Dorchester county, Maryland, May 17.

The claim under this patent is very brief, being to "the employment of cutting teeth in the front row of the concave, in the manner and for the purpose specified." These teeth forming the front row in the concave, or bed, "are made of steel, and sharp in front, to cut off all straw that enters crosswise, or would double round, if the teeth were not sharp."

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16. For a *Horizontal, Spiral Bucket, Water Wheel;* Lorenzo Dow Adkins, Perry, Wayne county, Ohio, May 17.

This wheel consists of a right and left handed spiral, or screw, meeting

in the centre of a shaft, and enclosed in a cylindrical case, which it must fit as nearly as may be. The water is to be let in through a trunk, at the middle of the case. The claims are in conformity with this arrangement. The spiral shaft will undoubtedly revolve under this construction, but the plan will not effect a general revolution in the manner of applying the power of water in mills.

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17. For improvements in the manner of constructing *Balance Locks for Canals;* Josiah White, city of Philadelphia, May 17.

The construction of this balance lock is, in general, similar to such as are described in the books, but it contains some improvements, which appear likely to render it more stable and efficient, than those heretofore essayed. The points claimed, are the following:

1st. "The employment of drums without gudgeons, and sustained on friction wheels, or rollers, as a substitute for the shafts and wheels, or pulleys, heretofore employed over the chambers of balance locks.

2nd. "The manner of employing bands of rolled iron, or steel, instead of chains, by which to suspend the caissons, or boxes, as described.

3rd. "The attaching the ends of the double bands of iron, or steel, to a vibrating lever, for the purpose of giving an equal tension to such bands.

4th. "The hanging the pool gates in movable frames, sliding in grooves, and adjusted by screws, for the purpose of adapting the said gates to the varying height of the water in the respective levels, as described."

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18. For improved *Ships' Galleys, for Distilling Salt Water;* Enoch Hutchinson, city of Baltimore, May 20.

The sides of this galley are to be made double, to admit the salt water, between them, which water is to be evaporated by the heat of the fire; the general principle is well known, and the patentee limits his claims, therefore, to the peculiar manner in which he has arranged the respective parts. These we shall not take the time and space to describe, as we are of opinion, that we should not by so doing, render any essential service, either to the patentee, or to the public, and should impose upon ourselves, the further task of assigning our reasons for not believing the plan to be one of any special merit.

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19. For a *Cooking Stove*; Darius Buck, city of Albany, New York, May 20.

In this stove, the fire chamber is above the oven, as in some other stoves, the special feature of novelty relied upon, consisting in enlarging the oven by carrying it under the lap, or hearth, in front of the stove. There is, of course, a downward draught from the fire, the flues from which are directed under and around the oven, in the manner pointed out in the specification. The downward, or reverberating flues are disclaimed, as are certain other parts described, the claims made, being to "the extending of the oven under the apron or open hearth of the stove, and the combination thereof, with the flues constructed as above specified; by which means I am enabled to obtain greater room for baking and other cooking purposes, and effect a greater saving of expense and fuel, than in cooking stoves of the ordinary construction."

20. For improvements in the *Roller Gin*, for ginning cotton; William Whittemore, Jr., West Cambridge, Massachusetts, May 25.

The claim is to the mode of scoring or grooving, the surface of the lower roller, in the manner and for the purpose mentioned." And it is said in the specification that the surface of the lower roller, which is formed of iron, is to have its surface scored, or indented, with a file, "or otherwise properly prepared for the purpose of causing the cotton to pass more readily between it and the upper roller."

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21. For improvements in *Cooking Stoves;* Micah Ketchum, Boston, Suffolk county, Massachusetts, May 25.

The only claim made under this patent, is to a "movable front fire plate, for the object and purposes set forth." This stove has a rotary top, very similar to those used in Stanley's, and other, stoves. Behind the fire chamber there is an oven, having a flue passing down in front of, and above it. The back plate of the fire chamber, constitutes the front plate of the front flue, and this plate is made capable of being raised up for the purpose of clearing out ashes from the flue. This, although the only thing claimed, does not appear to us, to be a very eligible mode of accomplishing the object intended, and we suppose that it stands alone, in consequence of the other devices described not having any claim to novelty. We have no doubt that the stove is a good one, but it does not appear to present any broad claim to invention.

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22. For an improvement in *Tanning*; William Herapath, city of Bristol, Great Britain, May 30.

The commencement of the specification of this patent is in the following words:

"I, William Herapath, of the city of Bristol, in the United Kingdom of Great Britain, hereby make oath, that I am the sole inventor of the system of tanning, by repeatedly passing hides, or skins, (connected together) between rollers placed over, or in, tan pits, described in the specification hereunto annexed, and for which a patent has been granted unto me, in connexion with James F. Cox, for fourteen years, from the 16th day of November, 1837, and the specification for the same, was published the 15th day of May, 1838, in England, in manner following."

The specification of this patent, is published in Vol. X, of the Repertory of Patent Inventions, for 1838. The claims made, are in the following terms.

"Having now fully described our said invention, and the manner in which the same is performed, we declare that we do not claim any parts of the machinery hereinbefore described, as being in themselves new, or newly combined; but what we claim as new, and of our invention, is the tanning of hides and skins, by connecting, or fastening them together, as hereinbefore directed, for the purpose of subjecting them to a quick and repeated alternation of absorption and expression, (absorption of fresh tanning liquor, and expression of the liquor when exhausted of its tannin, or partially so,) by means of a continuous application of one, two, or more, rollers, placed, adjusted, moved and regulated, and fed and supplied, in the manner hereinbefore directed; and such our invention being, to the best of our knowledge and belief, entirely new, and never before used. I do hereby declare this to be our specification of the same, and that I do verily believe this our

specification doth comply in all respects, fully, and without reserve or disguise, with the proviso in the said herein before in part recited letters patent contained; wherefore we do hereby claim to maintain exclusive right and privilege to our said invention."

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23. For *Pantaloon Straps*; W. H. Simpson, Boston, Massachusetts, May 30.

The nature of this invention will be understood by the claim, which is to "the mode described of constructing spring straps, for pantaloons, by attaching a simple coiled spring of wire, made flat, to the end pieces, by which the strap is to be attached to the pantaloons." This flat coiled spring is to extend entirely across, under the foot.

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24. For an improvement in the machines for *Crimping Boot Legs*; John Goodwin, Jr. Sterling, Worcester county, Massachusetts, May 30.

This crimping machine differs so little from some of its compeers and predecessors, as to render it unnecessary to give a description of it. By the devices claimed, the patentee believes, that he has rendered the machine more equal in its action, than those previously patented.

Progress of Practical and Theoretical Mechanics and Chemistry.

Description of the Turbine, or French and German Water Wheels. By George Rennie, Esq., F.R.S., &c. &c. *From the Railway Magazine.*

[In the course of some conversation we lately had with Mr. Rennie on this famed instrument, he informed us that he had seen one of them in France, whereupon we requested him to favour us with a description of it. This he has kindly done in the following paper, which we have no doubt will be read with great interest in this country. Our curiosity being excited by the care to conceal the invention, we did, between the time of speaking to Mr. Rennie and his sending us the article, consider the subject, and though we had never seen any account or description of the machine beyond the very vague one to the French Academy of Sciences, we hope if we have not Fourneyron's secret, we have something not much worse. We therefere set about preparing a somewhat elaborate paper on it and its application to steam-vessels and locomotives, but having received a much more complete article from Mr. Rennie than we had requested, or expected, we willingly yield the precedence to his, which, we doubt not, will prove infinitely more acceptable to our readers.—Ed. R. M., &c.]

It is somewhat remarkable in the annals of invention, that a machine which has excited so much interest in France and Germany, should have escaped the notice of journalists and scientific men* in this country.† A model of the turbine was brought over to this country a few years since, but nothing has been effected towards putting the principle into operation.

* In our 23d number, and one or two others, we gave a brief notice of this machine, which subsequently was copied into most of the newspapers. In the first notice there is an error by the translator in the quantity of water expended. It should be 1.06 cubic feet per second. —Ed.

† See Jour. Frank. Inst. vol. xxiii, p. 133.

Under these circumstances, a brief account of this curious machine may be interesting.

The turbine is neither more nor less than an improvement on the spiral wheel of the East, and the horizontal wheels so often met with in the south of France, Spain, Portugal, and Italy. Plates, and descriptions of these wheels, may be seen in the works of Zonca, Bockler, Ramelli, Walter, and Belidor; with this difference, however, that the water acts principally by its impulse.

Monsieur Naviere, in his notes on "Belidor's Architecture Hydraulique," gives the theory of the horizontal wheels which are employed at Toulouse and in the Pyrénées. In these examples the water acts by percussion only, and the result of the experiments of Messrs. Tardy and Piobert give about 0.34 of the power expended for the useful effect, while according to M. Poncelet's experiments in 1825, only $\frac{1}{15}$ of the power expended was rendered useful. M. Poncelet, whose researches in hydraulic science have been so valuable, gave, in 1826, a theory for the curves of an horizontal wheel, on the principle of reaction, namely, that the water should enter the wheel at the circumference and leave it at the interior, without velocity. In 1833, M. Burdin (engineer of mines), proposed to construct another kind of wheel, which he designated turbine, but in 1823, previously in the year, M. Fourneyron had directed his attention to this machine, which, with unwearied perseverance, he succeeded in perfecting in the year 1833.

The machine of M. Burdin receives the water at the top of a cylinder, or vertical drum, and rejects it at the lower end. The water then flows either nearer or further from the circumference, according to the forms of the curves on the surface of the cylinder, the height of which should be regulated to half the height of the entire fall; whereas in the turbines of Fourneyron, the thickness of the cylinder is only a few inches. The water issues out of the curves horizontally from the interior of the cylinder, and penetrates in every direction the counter curves of the exterior-wheel, and escapes horizontally through vertical openings in the exterior-wheel; or, to simplify the explanation, we have only to imagine a wheel with curved buckets laid horizontally, and the column of water issuing from the centre to the circumference, or by reversing the system, cause the water to issue from the circumference towards the centre. So far the principle. But the main difficulty lies in the construction, and this M. Fourneyron has acquired by long experience.

Two turbines, constructed by M. Fourneyron, were experimented upon by M. Morin (so well known for his valuable experiments on friction, &c., &c.), one at Moussay, in the Vosges, and the other at Müllback, in the department of the Lower Rhine. The former has a fall of three metres, or 9.84 feet, and the latter a fall of seven or eight metres, or from 23 to 26 feet. The effects were measured by the friction lever of M. Prony, which was applied to the vertical axles of the turbines, and although the velocity of the turbine varied from 140 to 180 revolutions per minute, the difference between the actual expenditure, disposable effect of the fall, exceeded it only by $\frac{1}{17}$. It results from the experiments of M. Morin, first, that the wheel of Moussay of two feet nine inches diameter, and four and one-third inches in thickness, on a fall of twenty-four feet six inches, is equal to 45 horses, and, secondly, that from 180 to 290 turns per minute the useful effect is 69 per cent., and which is very little diminished when the wheel is drowned.

The results of M. Morin's experiments on the turbine of Müllback, were:

1st. That the wheel of the turbine having a diameter of $6\frac{1}{2}$ feet, and a thickness of one foot, and a fall of from $11\frac{1}{2}$ to 12 feet, transmits a useful effect of 91 horses.

2d. That at the velocity of from 50 to 60 turns per minute, with the sluice well opened, the useful effect is 78 per cent. of the power expended.

3d. That the velocity of the wheel may be varied very greatly without altering the effect more than from $\frac{1}{25}$ to $\frac{1}{30}$ of the maximum effect.

4th. That when the wheel is drowned it makes little difference from the effect when not drowned.

5th. That although the expenditure of the water may vary in quantity in the ratio of from three to five, the useful effect is sensibly the same.

M. Morin has made experiments upon other turbines which have led to similar results. But the results obtained at the spinning factory of M. d'Eichtal, at St. Blaise, in the Black Forest, are curious.

There, the wheel of the turbine is only 21 inches in diameter, the fall 354 feet in height, the number of turns 2,300, and the power 40 (60?) horses.

When at Paris in October, 1838, I was recommended by Messrs. Arago and Morin, to visit the turbine recently erected at St. Maure; circumstances prevented me from having the advantages of M. Morin's company, nevertheless the machine was very politely shown and explained to me. The following is a brief description:—

Diameter of the wheel of the turbine, 5 feet 8 inches.

Breadth of ditto, 10 inches.

Number of turns per minute, 55.

Height of fall, 11 feet.

Estimated power, 40 horses.

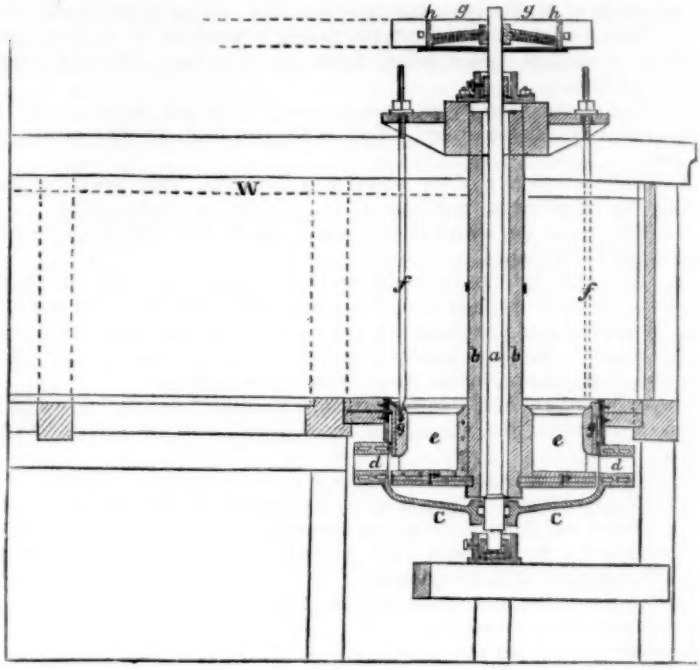
The axle as well as the other machinery, which was polished, had a crown wheel fixed near the bearing of the upper part, sufficiently large in diameter to drive 10 pinions, connected with as many millstones, each 40 inches in diameter, and they were then erecting three similar mills on the same floor, so that there were concentrated 40 pairs of millstones, driven by four turbines, equal in power to 40 horses each, or 160 horses altogether.

The machines were constructed by an English mechanic, established in Paris. I was, however, informed that no one possessed the art of laying out the curves but M. Fourneyron,* and that the attempt to construct one of these machines without the superintendence of the inventor would be attended with disappointment.

Messrs. Wedding and Carliczect, of Berlin,† have investigated the curves with attention, and find them to be cycloidal. See the annexed plate.

* We should like to save M. Fourneyron the trouble of guarding this secret any longer.—Ed. R. M., &c.

† Versiech mit horizontalen wosserradern, von Wedding et Carliczect.—Berlin, 1837.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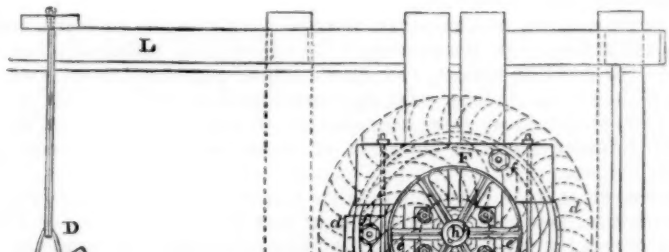
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Description of the Engraving.

L, Lever. W, Water level. F, Friction wheel. D, Dynamometer.
a, Main axle of the machine.
bb, Pipe which incloses it.
cc, Disk of the turbine fixed on the main axle.
ee, Curves or disks let into the platform PP.
dd, Curves on disks fixed round the circumference of the turbine, on which the water issuing out of the curves of platform PP, impinges.
ff, Bolts and screws for raising or lowering the circular sluice *gg*.

Operation.—To set the machine in motion the sluice *gg* is drawn up by means of the screws and bolts *ff*.

The water, which is continually resting on the platform PP, with the pressure of the whole fall, immediately issues out between the curve disks, and, impinging on the exterior curves of the turbine, causes it and the main axle, with all its machinery, to revolve rapidly.

In the annexed engraving, a friction wheel and friction break are attached to a lever, the vibration of which, and consequent power of the machine, are ascertained by the dynamometer.

The advantages of these machines are their simplicity and economy; they occupy very little room and can be placed in situations where a common vertical water wheel could not. The facility with which their velocities can be increased or diminished renders them well calculated for spinning, or for any mechanical operation which requires uniformity in changes of velocity *ad libitum*, and whereby increase or diminution of velocity may be obtained without the intervention of a train of wheels and their consequent friction and loss of power. To use the words of the commission appointed to examine the report of M. Morin, "The turbine is, of all the hydraulic machines in use, the most effective that has yet been compressed in the smallest form."*

GEORGE RENNIE.

New Source of Light.

M. Seguin has communicated to the Académie des Sciences, at Paris, a memoir on the distillation of animal substances, in which he states, that he has reduced the process to such a degree of simplicity, as to render it profitable for the sake of the products of the distillation. Thus, from the carcase of a horse he obtained, by destructive distillation, 700 cubic feet of gas, suitable for purposes of illumination, 24 lb. of sal ammoniac, and 33 lb. of animal black. The gas obtained was found to be composed of one part of olefiant gas and four of carburetted hydrogen, and might be preserved for months, in contact with water, without being in any way injured, or its brilliancy, as a combustible, impaired. M. Seguin found that 3,234 cubic inches of this gas, when burnt for one hour, gave twice and a half as much light as a Carcel lamp.

Athenæum.

The Clinometer.

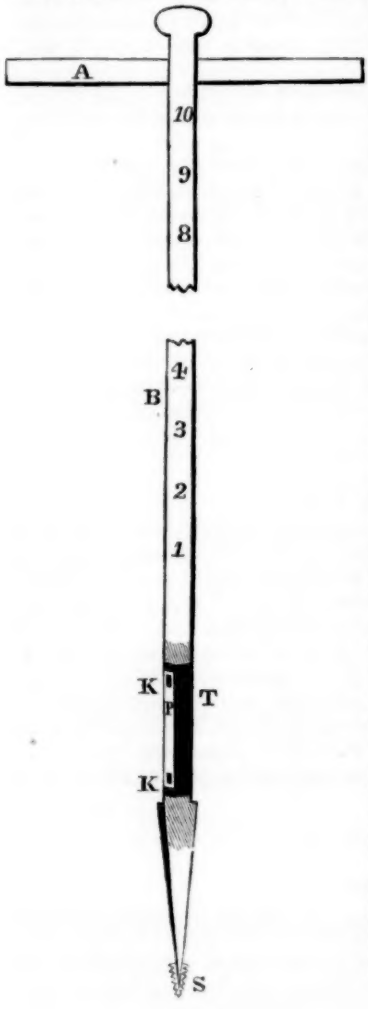
Sir,—This instrument takes its name from two Greek words, signifying a

* Expériénces sur les Roues Hydrauliques a arbre vertical appelée turbine, par Arthur Morin, Capitaine d'Artillerie, &c. &c., Metz.

bed, or *strata*, and a *measure;* it is therefore intended for the purpose of ascertaining the depth of soft mineral, or earthy, strata.

Explanation.—A, a cross piece for working the instrument; B, a strong pole graduated to feet, &c. for fixing to T a stout iron tube with an opening equivalent to one-third the circumference as shown at P. P, an inner tube to work freely upon the interior of T, of similar shape. K, K, projections for opening and shutting the instrument; S, a suitable screw for working the instrument into the ground.

A simple and efficient instrument for this purpose has long been a desideratum. If a landed proprietor or surveyor is desirous of ascertaining the nature of the subsoil of an estate, or an engineer the subsoil of the bed of a river (as in the case of the Thames Tunnel,) with the means generally employed for such purposes, it becomes an operation of considerable time, trouble and expense. The landed proprietor or surveyor, goes to work by taking with him one or two men with pick, shovel, &c., who commence operations (perhaps in the centre of a fine meadow) by digging an unsightly pit some three or four feet square, and so reach the required depths. The engineer on the other hand, will, supposing him to go about the job *sans cérémonie*, in the method at present employed, bring with him augers, borers, &c., and by abstracting the earth by little and little, arrive at the required information. But with my instrument, the surveyor will soon accomplish his task. Throwing it over his shoulder as he would his gun, off he goes, and having fixed upon a spot, takes the cross piece, passes it through the hole at the top of the instrument, introduces the same into the ground, and works it down screw-fashion, from left to right, (the inner tube remaining shut.) After working it to the required depth, as indicated upon the stalk of the instrument, the motion is reversed, when the resistance of the projections upon the inner tube to the surrounding earth will cause the instrument to open and to charge itself with the soil at such depth. The motion being again reversed, will cause the tube to close; when the instrument, being withdrawn, will be found to contain, pure unmixed soil, taken from the required depth, that is, the soil through which the tube was passing, when the motion of the instrument was reversed.



Trusting that this invention will be of considerable utility,
I am, yours, &c. Wm. Jones.
Manchester, Dec. 16, 1839.

Analysis of a piece of iron converted, by the action of Sea water, into a substance resembling Plumbago. By D. Mushet.

In this communication Mr. Mushet gives the result of his analysis of a piece of the iron heel-post of a vessel, called the *John Bull*, which, by the effect of salt water, was converted into a substance resembling plumbago. This substance was of a dark brown color, and easily cut by a knife; on being exposed to a red heat, in a crucible, it lost about 20 per cent. in weight, and on being exposed to a white heat for four hours, it lost about 60 per cent. and came out a light mass of very brilliant carburet. This shining carburet was then used as a carbonaceous substance for the reduction of an oxide of iron, but was less efficacious than the same quantity of the charcoal of wood. From these and other experiments, Mr. Mushet considers 100 parts to be composed as follows:—

Carbonic Acid and Moisture,	20
Protoxyde of Iron, -	35.7
Silt, or earthy matter, -	7.2
Carbon, - - -	41.1

Progress of Civil Engineering.

Report, by Andrew Ure, M.D., F.R.S., &c., *upon the asphalte rocks of Val-de-Travers, Seyssel, Pyrimont, &c., and their application as a mastich in foot-pavements, roofs, aqueducts, cisterns, &c.*

It is a very remarkable fact, in the history of the useful arts, that asphalte which was so generally employed as a solid and durable cement in the earliest constructions upon record, as in the walls of Babylon, should, for so many thousand years, have fallen well nigh into disuse among civilized nations. For there is certainly no class of mineral substance so well fitted as the bituminous, by their plasticity, fusibility, tenacity, adhesiveness to surfaces, impenetrability by water, and unchangeableness in the atmosphere, to enter into the composition of terraces, foot-pavements, roofs, and every kind of hydraulic work. Bitumen, combined with calcareous earth, forms a compact, semi-elastic solid, which is not liable to suffer injury by the greatest alternations of frost and thaw, which often disintegrate, in a few years, the hardest stones; nor can it be ground to dust and worn away by the attrition of the feet of men and animals, as sandstone, flags, and even blocks of granite are. An asphalte pavement, rightly tempered in tenacity, solidity, and elasticity, seems to be incapable of suffering abrasion in the most crowded thoroughfares; a fact exemplified of late in a few places in London, but much more extensively, and for a much longer time, in Paris.

The great Place de la Concorde, (formerly Place Louis Quinze) is covered with a beautiful mosaic pavement of asphalte; many of the promenades on the Boulevards, formerly so filthy in wet weather, are now covered with a thin bed of bituminous mastich; free alike from dust and mud, the foot

paths of the Pont Royal and Pont Carousel, and the areas of the great public slaughter houses, have been for several years paved in a similar manner, with perfect success. It is much to be regretted that the Asphalte Companies of London made the ill-judged, and nearly abortive, attempt to pave the carriage-way, near the east end of Oxford street, and especially at a moist season, most unpropitious to the laying of bituminous mastich. Being formed of blocks not more than three or four inches thick, many of which contained much silicious sand, such a pavement could not possibly resist the crash and vibration of many thousand heavy drays, wagons, and omnibuses daily rolling over it. This failure can afford, however, no argument against rightly constructed foot-pavements and terraces of asphalte. Numerous experiments and observations have led me to conclude that fossil bitumen possesses far more valuable properties for making a durable mastich, than the solid pitch obtained by boiling wood or coal tar. The latter, when inspissated to a proper degree of hardness, becomes brittle, and may be readily crushed into powder, while the former, in like circumstances, retains sufficient tenacity to resist abrasion. Factitious tar and pitch being generated by the force of fire, seem to have a propensity to decompose by the joint agency of water and air, whereas mineral pitch has been known to remain for ages without alteration.

Bitumen alone is not so well adapted for making a substantial mastich, as the native compound of bitumen and calcareous earth, which has been properly called ASPHALTIC ROCK, of which the richest and most extensive mine is unquestionably that of the *Val-de-Travers*, in the Canton of Neufchatel. This interesting mineral deposit occurs in the Jurassic limestone formation, the equivalent of the English oolite. The mine is very accessible, and may be readily excavated by blasting with gunpowder. The stone is massive, of irregular fracture, of a liver-brown colour, and is interspersed with a few minute spangles of calcareous spar. Though it may be scratched with the nail, it is difficult to break by the hammer. When exposed to a very moderate heat, it exhales a fragrant ambrosial smell, a property which at once distinguishes it from all compounds of factitious bitumen. Its specific gravity is 2114, water being 1000, being nearly the density of bricks. It may be most conveniently analyzed by digesting it in successive portions of hot oil of turpentine, whereby it affords 80 parts of a white pulverulent carbonate of lime, and 20 parts of bitumen in 100. The asphalte rock of Val-de-Travers seems, therefore, to be far richer than that of Pyrmont, which, according to the statement in the specification of Claridge's patent, of November, 1837, contains "carbonate of lime and bitumen in about the proportion of 90 parts of carbonate of lime to about 10 parts of bitumen."

The calcareous matter is so intimately combined and penetrated with the bitumen, as to resist the action not only of air and water for any length of time, but even of muriatic acid; a circumstance partly due to the total absence of moisture in the mineral, but chiefly to the vast incumbent pressure under which the two materials have been incorporated in the bowels of the earth. It would indeed be a difficult matter to combine, by artificial methods, calcareous earth thus intimately with bitumen, and for this reason the mastichs made in this way are found to be much more perishable. Many of the factitious asphalte cements contain a considerable quantity of silicious sand, from which they derive the property of cracking and crumbling down when trodden upon. In fact, there seems to be so little attraction between

silicious matter and bitumen, that their parts separate from each other by a very small disruptive force.

Since the asphalte rock of Val-de-Travers is naturally rich enough in concrete bitumen, it may be converted into a plastic workable mastich of excellent quality for foot-pavements and hydraulic works at very little expense, merely by the addition of a very small quantity of mineral, or coal tar, amounting to not more than six or eight per cent. The union between these materials may be effected in an iron caldron, by the application of a very moderate heat, as the asphalte bitumen readily coalesces with the tar into a tenacious solid.

The mode adopted for making the beautiful asphalte pavement at the Place de la Concorde in Paris was as follows:—The ground was made uniformly smooth, either in a horizontal plane, or with a gentle slope to carry off the water; the curb-stones were then laid round the margin by the mason, about four inches above the level of the ground. This hollow space was filled to a depth of three inches with concrete, containing about a sixth part of hydraulic lime, well pressed upon its bed. The surface was next smoothed with a thin coat of mortar. When the whole mass had become perfectly dry, the mosaic pattern was set out on the surface, the moulds being formed of flat iron bars, rings, &c., about half an inch thick, into which the fluid mastich was poured by ladles from a caldron, and spread evenly over.

The mastich was made in the following way:—The asphalte rock was first of all roasted in an oven, about ten feet long and three broad, in order to render it friable. The bottom of the oven was sheet iron, heated below by a brisk fire. A volatile matter exhaled, probably of the nature of naphtha, to the amount of one-fortieth the weight of asphalte; after roasting, the asphalte became so friable as to be easily reduced to powder and passed through a sieve, having meshes about one-fourth of an inch square.

The bitumen destined to render the asphalte fusible and plastic, was melted in small quantities at a time, in an iron caldron, and then the asphalte in powder was gradually stirred in to the amount of twelve or thirteen times the weight of bitumen. When the mixture became fluid, nearly a bucketful of very small, clean gravel, previously heated apart, was stirred into it; and as soon as the whole began to simmer with a treacley consistency, it was fit for use. It was transported in buckets, and poured into the moulds.

For the reasons above assigned, I consider this addition of rounded, polished, silicious stones to be very injudicious. If any thing of the kind be wanted to give solidity to the pavement, it should be a granitic, or hard, calcareous sand, whose angular form will secure the cohesion of the mass. I conceive, also, that tar, in moderate quantity, should be used to give toughness to the asphaltic combination, and prevent its being pulverized and abraded by friction.

In the able report of the Bastenne and Gaujac Bitumen Company, drawn up by Messrs. Goldsmid and Russel, these gentlemen have made an interesting comparison between the properties of mineral tar and vegetable tar: the bitumen composed of the latter substance, including various modifications extracted from coal and gas, have, so far as they were able to ascertain, entirely failed. This bitumen, owing to the qualities and defects of vegetable tar, becomes soft at 115° of Fahrenheit's scale, and is brittle at the freezing point; while the bitumen, into which mineral tar enters, will sustain 170° of heat, without injury. In the course of the winter, 1837–38, when the cold was at 14½° below Zero, the bitumen of Bastenne and Gau-

jac, with which one side of the Pont Neuf at Paris is paved, was not at all impaired, and would, apparently, have resisted any degree of cold; while that in some parts of the Boulevard, which was composed of vegetable tar, cracked and opened in wide fissures. The French Government, instructed by these experiments, has required, when any of the vegetable bitumens are laid, that the pavement should be an inch and a quarter thick; whereas, where the bitumen composed of mineral tar is used, a thickness of three quarters of an inch is deemed sufficient. The pavement of the bonding-warehouse at Bordeaux, has been laid upwards of fifteen years by the Bastenne Company, and is now in a condition as perfect as when first formed. The reservoirs constructed to contain the waters of the Seine at Batignolles, near Paris, have been mounted six years, and notwithstanding the intense cold of the winter of 1837, which froze the whole of their contents into one solid mass, and the perpetual water pressure to which they are exposed, they have not betrayed the slightest imperfection in any point. The repairs done to the ancient fortifications at Bayonne, have answered so well, that the Government, two years ago, entered into a very large contract with the company for additional works, while the whole of the arches of the St. Germain and St. Cloud Railways, and the pavements and floorings necessary for these works, are being laid with the Bastenne bitumen.

The mineral tar in the mines of Bastenne and Gaujac is easily separated from the earthy matter with which it is naturally mixed, by the process of boiling, and is then transported in barrels to Paris or London, being laid down in the latter place to the company at 17*l.* per ton, in virtue of a monopoly of the article purchased by the company at a sum, it is said, of 8000*l.*

Mr. Harvey, the able superintendent of the Bastenne Company, was good enough to supply me with various samples of mineral tar, bitumen, and asphaltic rock for analysis. The tar of Bastenne is an exceedingly viscid mass, without any earthy impurity. It has the consistence of baker's dough, at 60° of Fahrenheit; at 80° it yields to the slightest pressure of the finger; at 150° it resembles a soft extract, and at 212° it has the fluidity of molasses. It is admirably adapted to give plasticity to the calcareous asphaltes.

A specimen of Egyptian asphalte which he brought me, gave, by analysis, the very same composition as the Val-de-Travers, namely, 80 per cent. of pure carbonate of lime, and 20 of bitumen. A specimen of mastich, prepared in France, was found to consist, in 100 parts, of 29 of bitumen, 52 of carbonate of lime, and 19 of silicious sand. A portion of stone called the natural Bastenne rock, afforded me 80 parts of gritty silicious matter, and 20 of thick tar. The Trinidad bitumen contains a considerable portion of foreign earthy matter; one specimen having yielded me 25 per cent. of silicious sand; a second, 28; a third 20; and a fourth, 30: the remainder was pure pitch. One specimen of Egyptian bitumen, specific gravity 1.2 was found to be perfectly pure, for it dissolved in oil of turpentine without leaving any appreciable residuum.

Robinson's Parisian Bitumen Company, use a mastich made with the pitch obtained from boiling coal tar mixed with chalk. One piece laid down by this company at Knightsbridge and another at Brighton, are said to have gone to pieces. The portion of pavement laid down by them in Oxford street, next Charles street, has been taken up. Claridge's Company have laid down their mastich under the archway of the Horse-Guards, and in the carriage entrance at the Ordnance-office; the latter has cracked at the

junction with the old pavement of Yorkshire curb stone. The foot-pavement laid down by Claridge's company at Whitehall, has stood well. The Bastenne Company has exhibited the best specimen of asphalte pavement in Oxford street; they have laid down an excellent piece of foot pavement, near Northumberland house; a piece, 40 feet by seven, on Blackfriars-bridge; they have made a substantial job in paving 830 superficial feet, in front of the Guard-room at Woolwich, which though much traversed by foot passengers, and beat by the guard in grounding arms, remains sound; lastly, the floor of the stalls belonging to the cavalry barracks of the Blues at Knightsbridge, is probably the best example of Asphaltic pavement laid down in this country, as it has received no injury from the beating of the horses' feet.

As the specific gravity of properly made mastich, is nearly double that of water, a cubic foot of it will weigh from 125 to 130 lbs.; and a square foot three quarters of an inch thick, will weigh very near eight pounds. A ton of it will, therefore, cover 280 square feet. The prices at which the Bastenne Bitumen Company sell their products, is as follows:—

Pure mineral tar, £24 per ton, or 28s. per cwt.
Mastich, 8 8s. 10 "

		SIDE PAVEMENT.	ROOFS AND TERRACES.
From 50	to 100 feet,	1s. 3d. per foot,	1s. 6d. per foot.
100	250	1 1	1 4
250	500	0 11	1 1
200	750	0 10	1 0
750	1000	0 9	0 11
1000	2000	0 8	0 10
2000	5000	0 7	0 9

Where the work exceeds 5000 feet, contracts may be entered into.

For filling up joints of brickwork, &c., from 1d. to 1¼d. per foot, run according to quantity.

These prices are calculated for half an inch thickness, at which rate a ton will cover 420 square feet.

As the Val-de-Travers Company engage to lay down their rich asphaltic rock in London at 5*l.* per ton, and as a mineral tar equal to that of Seissel may probably be had in England, at one-fourth of the price of the foreign article, they may afford to lay their mastich three-quarters of an inch thick, per the thousand feet, including a subtratum of concrete, at a rate of fivepence a square foot, instead of fifteenpence, being the rate charged under that condition, by the Bastenne Company.

These charges are for London and its immediate vicinity.

13, Charlotte street, Bedford Square, April 22nd, 1829. Min. Jour.

Description of the Hypsometer, an Instrument invented by JOHN SANG, *Esq., Land Surveyor, for taking the Heights of Trees, Buildings, and other objects. Communicated by* MR. SANG, *Land Surveyor, Kirkcaldy.*

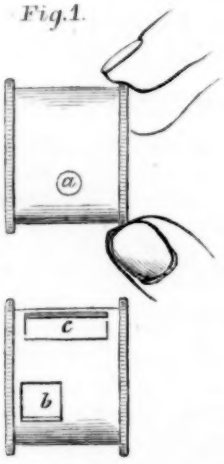
I have taken the first leisure hour to make you the instrument for measuring the height of trees and buildings which I mentioned to you when having the pleasure of visiting you at Bayswater. It is sent by post at the same time as this letter.

The instrument was tried on some houses and trees here, and it gave their height (especially the houses) with great accuracy. It is rather dif-

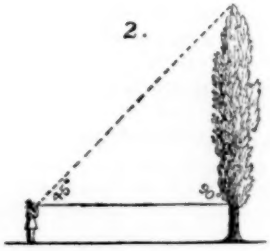
ficult to manage at first, but after a few trials it becomes quite easy. The method is as follows:—

By means of a small hook (if a knot of white cloth be attached to it, so much the better), fix the end of a tape line to the bole of the tree, at exactly the height of the observer's eye from the ground. Retire from the tree, letting the tape line unwind until, by using the instrument, the top of the tree and the end of the tape line are seen quite close together. Add the height of the observer's eye to the length of the tape line, and the sum is the height of the tree. Now, the difficulty is, to catch the image of the top of the tree in the instrument, and it is this which requires a few trials, although any person who has been accustomed to use a sextant will do it at the very first. Hold the instrument by one of the milled ends, taking care that the fingers do not project over any of the holes, and that the brim of the hat is out of the way. Apply the eye to the round hole marked *a* in fig. 1, and look through in the direction of the small square hole *b*, the instrument being held so that the line joining *a b* is about level, while the large square hole *c* is turned towards the sky. You will then see some object directly through the small hole, and at the same time the image of some other object, the light from which enters the large aperture, and, after being reflected by the two mirrors inside, passes into the eye. Whatever two objects are thus seen in contact, subtend at the eye an angle of 45°, as in fig. 2; so that, if one of them be the end of the tape line on a level, or nearly so, with the observer's eye, while the other is the top of a tree, supposed to be growing straight up, the distance from the eye to the bole of the tree will be exactly equal to the distance from the end of the tape line to the top of the tree.

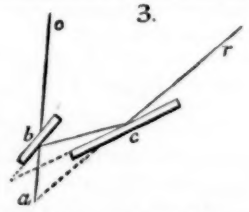
Fig.1.



2.



3.



4.

You will thus observe that the accuracy of the measurement depends on the tree being erect from the ground. On sloping ground the measurer would require to go out from the tree in such a direction that the tape line was perpendicular to the stem, but this could be judged sufficiently well by the eye to give the height, of even a very high tree, nearly correctly. The heights of those houses I tried were given within an inch, which was no doubt owing to their being perfectly upright on a level court yard.

The principle of the instrument is quite simple, being exactly the same as that of the sextant or quadrant, only that the mirrors are fixed at a certain angle instead of being movable. Thus, in fig. 3, *a* is the eye, *b* a mirror partly silvered, and *c* a larger mirror wholly silvered. A ray of light *r*, falling on the mirror *c*, is reflected from it in the direction *c b*, and again reflected from the mirror *b* in the direction *b a* to the eye; at the same time another ray of light comes from an object *o* direct to the eye at *a*, without being reflected. From the nature of reflected light, the angle *r a o* is equal to twice the inclination of the mirrors, and is constant, however much the whole instrument may be moved in the plane of the objects, as you will easily perceive by catching the reflection of the candle in the instrument, and moving it in the plane of the milled ends.

I am sure this very portable instrument will be useful for measuring single trees, or buildings, which are as far asunder as they are high, but I am afraid it will not work well in a close wood, on account of the operator not having room to retire as far from the trees as their height. If this is found to be the case, the remedy is to construct another instrument in which the mirrors are placed so as to give an angle of 63° 26′ 05″. In this case the height of the trees will be equal to twice the length of the tape, added to the height of the observer's eye. (See fig. 4.) Of course a small deviation from squareness in the trees and tape line will make a greater error than with the instrument sent, but still it will give a result near enough for all practical purposes.

I have only to add, that the mirrors are made of common window glass selected as the most even from among a great many pieces, but still they are not quite flat. I had some glass from London perfectly true and flat, but so dim and badly polished as to be unfit for use.

Kirkcaldy, Jan. 31, 1840.

Gardeners' Mag.

Postscript in Answer to some Questions asked of Mr. Sang by the Conductor.

The instrument for measuring the height of trees is not a pocket sextant, like that of Mr. Blackadder, mentioned in vol. xiv. p. 257, although nearly allied to it. The sextant, quadrant, reflecting circle, improved Wollaston's goniometer, as well as the optical square and tree-measurer, are all varieties or improvements on Hadley's first invention. The two latter differ from the rest in the mirrors being permanently fixed at angles suitable for the purposes for which they were intended. The pocket sextant would measure the height of trees quite as well, but, being expensive, and requiring some skill to use it, it is not likely to be much employed for such purposes. There is no sort of merit in designing the instrument; and it so exceedingly simple, that I have no doubt the idea of modifying the sextant, so as to make it readily measure the height of trees, has occurred to many a one. I, however, never heard of such an instrument, and believe that the one you have is the second of its kind in existence. The other is one which was made for yourself. My father was so much pleased with it that he asked me to make one for him, which turned out neater than the first, and accordingly I sent it to you, as being the better of the two. As there is nothing like a Greek name for giving identity to it, you might call it a dendrometer, or, better still, a hypsometer (measure of height).

Of course any instrument maker could supply these articles; the price, I should think, would be about 20*s*. each. If there were any prospect of sell-

ing a dozen or two, I could easily employ a workman here to make them, and they might be sent from the seedshop to any place by post.

Kirkcaldy, Feb. 18, 1840. Gardner's Mag.

Description of a Polyphotal Lamp, and Reflector of Single Curvature, employed in Steam Vessels, Canal Boats, &c. By John Scott Russel, A. M., F. R. S. E., V. P. S. A.*

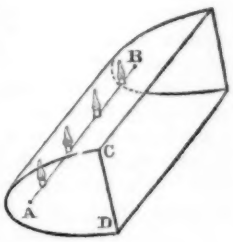
Several years ago I was applied to by Mr. Ellis, the Secretary of the Union Canal, to assist in some contrivances for expediting canal transport, and adding to its security. Amongst other things, this lamp and reflector resulted from this application. It has been in constant use ever since; it is now used also on the Forth and Clyde Canal, and is about to be introduced in steam vessels. It is also capable of being used with advantage in many other situations, where concentration is not required.

The view with which this lamp was constructed was that of throwing light forward before the boat upon all the objects in a certain range, and to a great distance, so as to illuminate the banks of the canal, to throw light upon any vessel coming in the opposite direction,—to throw a light on the horse's path and on the arches of the bridges, so that the horses, their rider, and the helmsman, might clearly see and avoid them. All this the lamp has, for four or five years been successfully accomplishing. It is, besides, not expensive, and is kept in order by the common boatmen without difficulty.

The lamp is polyphotal, or allows several lights or burners to be used simultaneously in the same reflector. The reflector being of single curvature, is easily made, and at little expense.

The construction of the reflector may be easily understood by conceiving a thin sheet of silver, strengthened by being united to a copper plate, to be bent round in the middle, so as to coincide with a parabola, and form a species of conoid or surface, whose section, at right angles to the plane of the parabola, is rectilinial.

In the focal transverse axis of this figure, that is in the line joining the foci of the parabolas, at the two ends of this figure, are placed any number of lights, as in the lamp exhibited.



The figure which is thus formed has this property, that a plane vertical section though any point in the transverse focal axis A B, is a parabola whose focal distance varies with the angle of divergence. The new focus may be found by the formula: $f^1 = f^2 \cos \theta$, f being the direct focus of the primary parabola, and f^1 the focus of the parabola inclined at the angle θ.

For the divergent rays, therefore, it follows that, so long as the radius of the flame does not exceed the difference between f and f^1 in the formula, the parallelism of the rays in a vertical plane will be perfect for a certain part of the flame.

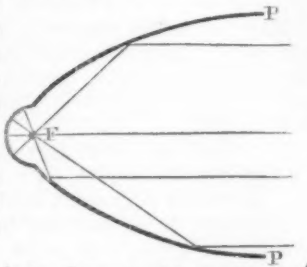
I have taken, of course, for granted, as in the case before us, that lateral divergence is wanted, and that vertical divergence alone would be consider-

* Read beford the Society of Arts for Scotland, November 13, 1839.

ed a loss; or, in other words, that light is wanted to spread forwards, on both sides, but not upwards or downwards.

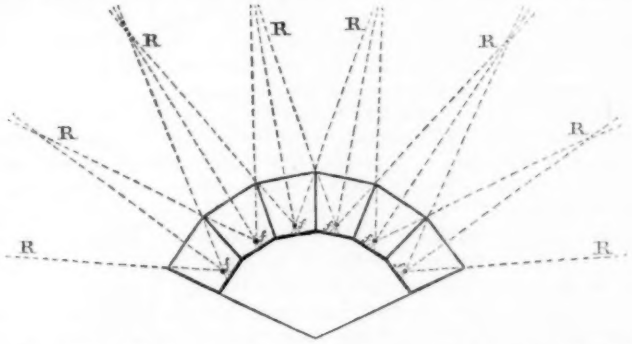
The ends of the lamp are formed in the same way as the top and bottom, but this is perhaps unnecessary where horizontal divergence is of no consequence, as they might be plain surfaces without much loss.

It is of consequence, in the case of the lamp exhibited, to have the focus of the reflector short; this would bring the burners too close to the back, and as light is required for dispersion in the vicinity, the back is cylindrical, and concentric with the transverse focal axis A B. The effect of this is seen in the annexed diagram, where F is the focus of the parabola and the centre of the attached semicircle, whose radius is equal to the semiparameter.



The use of such a lamp in a steam-vessel, is to show an object a-head of the vessel, and to assist them in navigating narrow channels or rivers at night. The canal boats go now with these lamps, in a dark night, at the rate of ten miles an hour, as safely as in the day.

The same principle is applicable to a pier-light, or a directing light, which extends through a part only of the horizon, so as to render lenses inapplicable. This arrangement is shown in the following drawing:—



The lines *f* R, *f* R, &c., give the rays divergent in every direction horizontally, and only rendered parallel in the vertical planes, through each of the foci *f f f*. The zone of light would thus be complete in every direction, without the dark intervals produced by reflectors of double curvature, which only emit one large parallel beam.

It is, however, to be remembered that, when it is required to carry a parallel beam of light only in a single direction, and to a great distance, this species of reflector and lamp can be of no service, its use being to carry forward a powerful light over a horizontal angle of considerable extent.

Edinburgh New Philosophical Journal.

NOTICE FROM THE FRENCH JOURNALS. TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE, BY J. GRISCOM.

On a sounding or boring executed at Cessingen, in the Grand Duchy of Luxemburg.

(Extract of a letter from M. Levallois, Engineer in Chief of Mines.)

They are at this moment at work at a sounding, at the village of Cessingen, about a league from Luxemburg, which deserves particular notice. On the first of April 1839, they had attained the depth of 534 metres (= 1752 feet) the greatest, certainly, which has been reached in Europe, up to the present time.

The object of this enterprise, is rock salt. The undertaker is M. Rost, a skilful Saxon engineer, on account of a company, in which the most notable financiers of Brussels are interested. It was commenced on the first of February, 1837, and they are now advancing at the rate of a metre in twenty-four hours. To proceed successfully, at a depth hitherto unattained, requires a directing intelligence, capable of surmounting obstacles which continually present themselves in works of this nature, especially when I add, that it is done by a *stem* borer, and that the stem, or rod, is but three-fourths of an inch in thickness. It belongs to M. Rost to explain, in detail, the various inventions which he has devised, but I wish to give an idea of what he calls his parachute, because to this he attributes, in a great degree, the successful progress of his boring.

It is well known that upon the sounding rod, if a borer breaks, which is often the case, the unsupported portion of it in falling, is broken by the shock, into several fragments, which become so wedged together in the hole as to render their abstraction very troublesome. To prevent such an effect from the fall, M. Rost contrived his parachute.

This additional piece is attached to the lower part of the rod, which is there strengthened for the purpose, so as to be certain that the fracture will not occur at that place. It consists of a wooden sleeve or muff, through which the rod can freely play through a space rather greater than the leap, or stroke of the sound. Below this muff, are attached by iron bolts several targets of superimposed leather, of a diameter just equal to that of the hole which is thus, as it were, stoppered by a kind of piston. Now, when the stem breaks, the upper part can fall only through a space equal to the play of the borer through the muff, and when the stop which limits this play strikes the head of this piece, it can only descend very slowly, in consequence of the friction of the leather against the sides of the hole.

M. Rost has also diminished the frequency of ruptures, by making the first three-sevenths of his rod of wood four inches square.

The hole is tubed, four tubes having been introduced of decreasing diameters. M. Rost does not shrink at the idea of carrying his boring to the depth of 700 metres, or 2300 feet.

The beds already traversed are,	Metres.
Calcareous rock-lias,	62.00
Luxemburg free stone,	83.57
Greyish sandy marl,	25.43
Upper Kuperin marl; with gypsum and saline clay,	166.00
Stuttgard free stone,	8.90
Lower Kuperin marl; with gypsum and saline clay,	188.10
	534.00

Ann. des Mines, tome 16.

Observations on the influence of rarefaction upon the moisture contained in Air. By Prof. R. Hare.

To the Committee on Publications.

Gentlemen,—The fact that air saturated with water (but not in contact with it in a liquid state) when rarefied, indicates great dessicating power, led me, at the conversation meeting in May, to express doubts of the correctness of an opinion, which I had previously sanctioned in my text book, that the transient cloud observed in a receiver, subjected to exhaustion, arises from water in the aeriform state. Having lately rarefied air to one half of its previous density, and subsequently subjected the containing vessel to a freezing mixture, until a thermometer in the axis of the vessel was three degrees below freezing, I found the hygrometer to indicate dampness about ten degrees beyond the point at which it had stood at the beginning of the process; and at the same time a deposition of moisture took place. Agreeably to Dalton's tables I find that under these circumstances about two-fifths of the vapours should be condensed, and by calculation about twenty-five degrees of heat should be imparted to the surrounding air.

It follows that the condensing influence of a freezing temperature is paramount to the dessicating influence of a reduction of density to one half of that of the atmosphere; also that in passing from the neighbourhood of the terrestrial surface to an elevation of three miles, clouds will be formed in moist air previously at seventy degrees, by a cold near the freezing point, in consequence of the condensation of aqueous vapour: the caloric previously in the vapour being transferred to the air and causing a commensurate expansion.

In an essay, published in Silliman's Journal in 1822, I had made the inference that in passing from the state of vapour to that of snow, water would impart to the air as much heat as would be yielded by twice its weight of red hot powdered glass. I must grant to Mr. Espy the merit of pointing out the probable influence of the caloric thus evolved in increasing the comparative buoyancy of the air. I cannot, however, concur with him in the opinion that any buoyancy thus created would be adequate to produce a tornado or a hurricane, or that electricity is not a principal agent in the production of storms, clouds, rain, and snow.

In the translation of the moisture and air of the Atlantic, or of the Gulf of Mexico, to the sky of the United States, as in our northeastern or southeastern gales, I infer that the source of expansion to which he has drawn attention, may be a principal agent.

Yours sincerely,
Robert Hare.

ERRATA.

Page 164, line 10 from bottom, for "*water*" read "*matter.*"
165, " 27 " " for "*unprobable*" read "*improbable.*"

LUNAR OCCULTATIONS FOR PHILADELPHIA, AUGUST, 1840.

Angles reckoned to the right westward round the circle, as in an inverting telescope.
☞ For direct vision add 180°.

Day.	H'r.	Min.	Star's name.	Mag.	From Moon's North point.	From Moon's Vertex.
8	10	57	Im. (359) Sagittarii,	5	158°	134°
8	11	43	Em.		225	248
12	16	44	Im. d^2 Capricorni,	6	202	248
12	16	56	Em.		224	271
12	16	27	Im. d^3 Capricorni,	6	81	126
12	17	13	Em.		343	31
19	14	20	N. App. ☽ and 7 Tauri.	6	☽ South 1.′1	

Meteorological Observations for March, 1840.

Moon.	Days	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rises.	Barometer. 2 P.M.	Wind. Direction	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inch's	Inch's			Inches.	
	1	42	56	29.90	29.90	S.	Calm.	.10	Cloudy—showery.
	2	39	66	30.10	.90	S.W.	do.		Cloudy—hazy.
⊗	3	51	65	29.85	.80	E.S.	do.		Cloudy—do.
	4	54	72	.65	.50	S.W.	Brisk.		Hazy—clear.
	5	46	57	.50	.50	N.W.	do.		Clear—do.—Aurora.
	6	34	58	.65	.50	W.	do.		Clear—do.
	7	39	54	.55	.51	W.	do.		Clear—do.
	8	21	40	.85	.80	N.W.	Moderate.		Clear—do.
	9	34	56	.40	.35	S.W.	Brisk.		Cloudy—clear.
☾	10	36	62	.35	.35	S.W.	do.	.6	Clear—flying clouds—snow.
	11	18	32	.70	.80	N.W.	do.		Clear—do.
	12	23	40	.95	.90	N.W.	do.		Cloudy—do.
	13	30	38	.75	.85	N.W.	do.		Cloudy—flying clouds.
	14	28	47	30.16	30.20	W.	do.		Clear—do.
	15	33	42	29.90	29.74	E.	Moderate.	.1	Snow—cloudy.
☉	16	37	52	.70	.75	W.	do.		Flying clouds—do. do.
	17	42	42	.50	.50	E.	do.	.21	Rain—cloudy.
	18	34	54	.85	.90	N.S.E.	do.		Cloudy—do.
	19	40	44	.80	.85	E.	do.	.19	Cloudy—rain.
	20	42	49	.85	.95	N.E.	do.		Cloudy—do.
	21	11	48	30.00	30.00	N.W.	do.		Cloudy—flying clouds.
	22	27	38	.23	.23	N.W.	do.		Clear—do.
	23	32	46	.10	.00	S.W.	do.		Partially cloudy—do.
	24	36	39	29.65	29.32	E.	Blustering	.70	Rain—snow.
	25	27	34	.40	.43	N.	Moderate.		Cloudy—do.
☽	26	26	42	.60	.60	N.W.	do.		Clear—do.
	27	37	59	.83	.85	S.	Brisk.		Cloudy—clear.
	28	48	55	.90	.93	S.W.	Moderate.		Cloudy—do.
	29	51	73	.80	.80	S.W.	do.	.4	Cloudy—shower.
	30	51	65	.60	.10	E.	Brisk.	.60	Rain—cloudy.
	31	36	50	.70	.70	W.	do.		Clear—flying clouds.
	Mean	36.81	51.45	29.77	29.74			1.94	

	Thermometer.	Barometer.
Maximum height during the month.	73.00 on 29th.	30.23 on the 22nd.
Minimum " "	18.00 on 11th.	29.32 " 24th.
Mean	44.13	29.755

METEOROLOGICAL REPORT

FOR THE STATE OF PENNSYLVANIA,

Collated from returns made to the Committee on Meteorology of the Franklin Institute of the State of Pennsylvania, for

JUNE, 1840.

	County.	Town.	Observer.	Thermometer.										Barometer.	
											Register.				
				7, A.M.	2, P.M.	9, P.M.	Maximum.	Minimum.	Mean.	Days omitted.	Lowest.	Mean.	Days omitted.	7, A.M.	2, P.M.
1	Philadelphia,	Philadelphia,	J. M. Hamilton,	69.41	76.86	71.87	87.00	54.50	72.71	1 1/2	48.00	61.32	2	30.03	30.0
2	Montgomery,														
3	Bucks,	Newtown,	L. H. Parsons,	70.20	76.10	64.30	88.00	52.00	70.20	.	42.00	56.08	2	29.94	29.9
4	Lehigh,														
5	Northampton,	Easton,	Charles Elliot,	62.83	72.42	65.00	85.00	49.00	66.82	1	....	....	.	....	....
6	Monroe,	Stroudsburg,	A. M. Stokes,	63.82	78.75	58.67	90.00	46.00	67.08	15	....	....	.	29.48	29.5
7	Pike,														
8	Wayne,														
9	Susquehanna,	Silver Lake,	E. Rose,												
10	Luzerne,	Wilkesbarre,	W. F. Dennis,												
11	Schuylkill,														
12	Berks,	Reading,	C. F. Egelmann,	66.00	71.83	64.80	87.00	50.00	67.54	.	...	...	.	29.82	29.8
13	Chester,														
14	Delaware,	Haverford,	Haverford School,	72.50	79.00	73.50	86.00	60.00	75.00	22	47.00	59.97	1	29.45	29.4
15	Lancaster,	Lancaster,	Conservatory of Arts,	66.07	78.22	67.32	89.00	53.00	70.54	.	46.50	65.08	.	29.47	29.4
16	York,														
17	Lebanon,														
18	Dauphin,														
19	Northumberland,	Northumberland,	Andrew C. Huston,	66.85	74.53	67.70	85.00	54.50	69.69	.	40.00	53.42	.	29.44	29.4
20	Columbia,	Danville,	C. H. Frick.												
21	Bradford,														
22	Tioga,														
23	Lycoming,														
24	Union,														
25	Mifflin,														
26	Juniata,	Mifflintown,	J. A. Rinkead,	58.84	77.36	66.65	87.00	51.00	67.62	2 1/2	....	....	.	29.45	29.38
27	Perry,														
28	Cumberland,	Carlisle,	Prof. W. H. Allen,	66.80	78.20	65.97	92.00	53.00	70.32	.	45.00	58.70	.	29.38	29.36
29	Adams,	Gettysburg,	Prof. M. Jacobs,	64.32	77.56	67.57	91.00	54.00	69.82	.	45.00	58.05	.	29.39	29.38
30	Franklin,														
31	Huntingdon,	Huntingdon,	Jacob Miller,	62.30	79.17	66.20	91.00	48.00	69.22	3 1/2	....	....	.	29.35	29.32
32	Centre,	Bellefonte,	John Harris,	61.67	78.48	65.27	89.00	47.00	68.47	3 1/2	....	....	.	29.25	29.23
33	Potter,														
34	M'Kean,	Smithport,	Richard Chadwick,	53.43	75.79	51.03	89.00	36.00	60.08	1/2	....	....	.	28.14	28.13
35	Clearfield,														
36	Cambria,	Ebensburgh,	Richard Lewis,												
37	Bedford,	Bedford,	Samuel Brown,	69.53	73.13	71.43	80.60	61.60	71.36	.	....	....	.	29.33	29.32
38	Somerset,	Somerset,	George Mowry,	61.19	74.08	69.98	81.00	45.00	64.42	1/2	38.00	54.78	.	27.95	27.94
39	Indiana,	Indiana,	Richard White,	70.87	77.77	69.47	89.00	47.00	69.57	.	51.00	47.90	.	28.61	28.61
40	Jefferson,	Rose Cottage,	C. C. Gaskell,												
41	Warren,	Warren,	C. S. Brown,	63.20	73.33	71.27	84.00	51.00	69.27	.	49.00	62.05	.	28.86	28.83
42	Venango,	Franklin,	Wm. Connely,	57.63	81.93	65.03	97.00	36.00	68.20	.	....	....	.	....	29.00
43	Armstrong,														
44	Westmoreland,														
45	Fayette,	Uniontown,	J. P. Weithers,	64.92	82.93	65.73	94.00	46.00	71.19	.	....	....	.	28.99	28.98
46	Green,														
47	Washington,	Cannonsburg,	Jno. H. Kennedy.												
48	Alleghany,	Pittsburgh,	G. P. Schiveley,												
49	Beaver,	Beaver,	Wm. Allison,	66.32	80.69	65.00	91.00	45.00	70.67	1	....	....	.	29.41	29.40
50	Butler,	Butler,	Jacob Mechling,	63.67	76.70	69.30	87.00	49.00	69.89	.	....	....	.	28.82	28.82
51	Mercer,	West Greenfield,	S. Campbell,												
52	Crawford,	Meadville,	J. Limber,	67.14	76.24	66.21	88.00	53.00	69.86	1 1/2	44.00	56.14	2	28.77	28.77
53	Erie,	Erie,	Park & Reid,	67.17	73.65	65.23	83.50	50.00	68.68	.	42.00	56.93	.	29.39	29.38

LUNAR OCCULT

Day.	H'r.	Min.	
8	10	57	Im.
8	11	43	Em.
12	16	44	Im.
12	16	56	Em.
12	16	27	Im.
12	17	13	Em.
19	14	20	N.

Met

Moon.	Days	Therm. Sun rise.	Therm. 2 P.M.
	1	42	58
	2	39	66
⊗	3	51	65
	4	54	72
	5	46	57
	6	34	58
	7	39	54
	8	21	40
	9	34	56
☾	10	36	62
	11	18	32
	12	23	40
	13	30	38
	14	28	47
	15	33	42
	16	37	52
⊕	17	42	42
	18	34	54
	19	40	44
	20	42	49
	21	11	45
	22	27	38
	23	32	46
	24	36	39
	25	27	34
☽	26	26	42
	27	37	59
	28	48	55
	29	54	73
	30	51	65
	31	36	50
	Mean	36.81	51.45

Maximum height dur
Minimum
Mean

Thermometer. 2, P. M.	9, P. M.	Maximum.	Minimum.	Mean.	Days omitted.	Register. Lowest.	Mean.	Days omitted.	Ba 7, A. M.	2, P. M.	9, P. M.
41 76.86	71.87	87.00	54.50	72.71	1⅓	48.00	61.32	2	30.03	30.02	30.
20 76.10	64.30	88.00	52.00	70.20	.	42.00	56.08	2	29.94	29.97	29.
83 72.42	65.00	85.00	49.00	66.82	1	....	....	.	....	....	.
82 78.75	58.67	90.00	46.00	67.08	15	....	....	.	29.48	29.50	29.
00 71.83	64.80	87.00	50.00	67.54	.	...	...	.	29.82	29.82	29.
50 79.00	73.50	86.00	60.00	75.00	22	47.00	59.97	1	29.45	29.44	29.
07 78.22	67.32	89.00	53.00	70.54	.	46.50	65.08	.	29.47	29.47	29.
85 74.53	67.70	85.00	54.50	69.69	.	40.00	53.42	.	29.44	29.41	29.
84 77.36	66.65	87.00	51.00	67.62	2⅔	....	....	.	29.45	29.38	29.
80 78.20	65.97	92.00	53.00	70.32	.	45.00	58.70	.	29.38	29.36	29.
32 77.56	67.57	91.00	54.00	69.82	.	45.00	58.05	.	29.39	29.38	29.
30 79.17	66.20	91.00	48.00	69.22	⅓	....	....	.	29.35	29.32	29.
67 78.48	65.27	89.00	47.00	68.47	3⅔	....	....	.	29.25	29.23	29.
13 75.79	51.03	89.00	36.00	60.08	⅓	....	....	.	28.14	28.13	28.
55 73.13	71.43	80.60	61.60	71.36	.	....	....	.	29.33	29.32	29.
19 74.08	60.98	81.00	45.00	64.42	⅓	38.00	54.78	.	27.95	27.94	27.
87 77.77	60.17	89.00	47.00	69.57	.	31.00	47.90	.	28.61	28.61	28.
20 73.33	71.27	84.00	51.00	69.27	.	49.00	62.05	.	28.86	28.83	28.
63 81.93	65.03	97.00	36.00	68.20	.	....	....	.	....	29.00	...
92 82.93	65.73	94.00	46.00	71.19	.	....	....	.	28.99	28.98	28.
32 80.69	65.00	91.00	45.00	70.67	1	....	....	.	29.41	29.40	29.
67 76.70	69.30	87.00	49.00	69.89	.	....	....	.	28.82	28.82	28.
14 76.24	66.21	88.00	53.00	69.86	1⅔	44.00	56.14	2	28.77	28.77	28.
17 73.65	65.23	83.50	50.00	68.68	.	42.00	56.93	.	29.39	29.38	29.

Barometer.							Weather.							Winds.																	Hygrometer.					
7, A. M.	2, P. M.	9, P. M.	Maximum.	Minimum.	Mean.	Days omitted.	Clear.	Cloudy.	Days omitted.	Rain.	Snow.	Rain and Snow.	Thunder Showers.	Rain in inches.	North.	N. N. E.	N. E.	E. N. E.	East.	E. S. E.	S. E.	S. S. E.	South.	S. S. W.	S. W.	W. S. W.	West.	W. N. W.	N. W.	N. N. W.	Calm.	Days omitted.	Dew-point.	Days omitted.	Diff. therm. and dew point.	Wet Bulb.	Days omitted.	No. of Report.
0.03	30.02	30.01	30.31	....	....	.	20 1/3	8 2/3	1	....	....	....	..	....	2/3	.	5 1/3	1/3	2/3	.	1	.	4	1 1/3	4 2/3	2/3	3	1 1/3	5 2/3	.	.	1 1/3	....	.	... .	....	.	1207
9.94	29.97	29.94	30.23	29.59	29.95	.	17	12 1/3	2/3	9	....	....	..	6.584	1/3	.	1 2/3	2	.	.	1	1	2	1	6 1/3	1	2	1	9	2/3	1/3	2/3	....	.	.....	....	.	1175
....	....	. ..	....	....	....	.	.	.	.	....	....	....	..	.....	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	....	.	.. ..	....	.	1109
9.48	29.50	29.46	29.65	29.20	29.48	14 2/3	3 2/3	10 2/3	15 2/3	....	....	....	..	.....	2 1/3	.	1/3	.	1 1/3	.	3	.	1/3	.	2 1/3	.	2 1/3	.	3 1/3	.	2/3	14	....	.	.....	....	.	1110
9.82	29.82	29.81	30.10	29.48	29.82	.	14	16	.	....	....	....	..	4.290	.	.	1	1/3	2/3	1/3	2 2/3	.	1	.	1 2/3	.	5 1/3	2/3	14 2/3	.	1 2/3	.	....	.	.....	....	.	1101
9.45	29.44	29.46	29.78	29.12	29.45	2 1/3	10 2/3	17	2 1/3	....	....	....	..	.....	2	2/3	1 1/3	2/3	2 1/3	.	.	1/3	1	1	5 1/3	1/3	4 1/3	2	2 1/3	2/3	3 1/3	2 1/3	56.62	6	.....	....	.	1111
9.47	29.47	29.47	29.81	29.13	29.47	.	19	11	.	7	....	....	4	3.715	3	.	1 2/3	.	4	1/3	2	1	2 1/3	2	4 1/3	2/3	2 2/3	1 1/3	3 1/3	1 2/3	.	.	62.86	.	.....	66.83	.	1107
9.44	29.41	29.42	29.77	29.08	29.42	.	9 2/3	20 1/3	.	8	....	....	4	4.710	2 2/3	.	1 2/3	.	3	.	3	1/3	6 1/3	.	1/3	1/3	4	.	5 2/3	1/3	2 1/3	.	....	.	.....	68.75	.	1097
9.45	29.38	29.40	29.78	29.11	29.41	3	9 2/3	16 2/3	3 1/3	....	....	....	..	3.990	1/3	.	2/3	.	1	.	2 3/3	.	.	.	2 1/3	.	2 2/3	.	5 1/3	.	12 2/3	2 1/3	....	.	.....	....	.	1099
9.38	29.36	29.36	29.68	29.04	29.37	.	16	14	.	10	....	....	..	2.069	1/3	1/3	1 1/3	.	1 2/3	.	1/3	.	1 2/3	.	2 2/3	.	7 2/3	1/3	3 2/3	.	10	.	....	.	.....	....	.	1156
9.39	29.38	29.38	29.67	29.07	29.38	.	19	11	.	8	....	....	1	2.381	4 1/3	.	2 2/3	.	.	.	.	.	2 2/3	1 2/3	3 1/3	1	4 1/3	1/3	3 1/3	1/3	5	1/3	54.94	12	.....	65.11	12	1145
9.35	29.32	29.33	29.66	29.00	29.33	1/3	19	11	.	7	....	....	2	4.536	.	.	.	.	11	.	.	.	.	.	.	.	18 1/3	.	.	.	.	1/3	....	.	.....	....	.	1166
9.25	29.23	29.26	29.57	29.02	29.25	3 1/3	12 1/3	14	3 1/3	....	....	....	..	6.073	1	.	2 1/3	.	2	.	2 2/3	.	2/3	.	7 1/3	.	3 1/3	.	6 1/3	.	.	4	....	.	.....	....	.	1167
9.14	28.13	28.14	28.80	27.95	28.14	1/3	13 1/3	16 1/3	1/3	11	....	....	1	3.935	1/3	.	.	.	2	.	3 1/3	.	.	.	8	.	10 1/3	.	3 1/3	.	.	2	....	.	.....	70.03	1	1203
9.33	29.32	29.33	29.64	28.96	29.33	.	16	14	.	.	....	.....	..	.....	1	.	.	.	1/3	.	2 2/3	1 1/3	6 2/3	.	1/3	.	14 2/3	1/3	2 2/3	.	.	.	....	.	.. .	....	.	1103
7.95	27.94	27.94	28.19	27.70	27.94	1/3	10 2/3	19	1/3	4	...	....	7	3.056	1/3	.	1	.	.	.	1 1/3	.	2/3	.	8 2/3	1/3	2 2/3	1 1/3	2 1/3	.	10 2/3	1/3	....	.	.....	....	.	1102
8.61	28.61	28.60	28.90	28.30	28.61	.	19	11	.	8	....	....	5	4.716	.	.	.	.	1/3	.	2	.	2/3	.	5	.	2 2/3	.	6 2/3	.	12 2/3	.	....	.	...	....	.	1108
8.86	28.83	28.83	29.15	28.49	28.84	.	20	10	.	9	....	...	5	4.812	1/3	1/3	1 1/3	.	.	.	4 2/3	.	1	1/3	6 1/3	2/3	1 2/3	.	2 1/3	.	10 2/3	.	....	.	....	....	.	1105
...	29.00	....	29.70	28.56	29.00	22 1/3	6	1 2/3	22 1/3	9	....	....	..	5.720	.	.	.	.	.	.	1 2/3	.	.	.	.	.	.	.	6	.	.	22 1/3	....	.	.....	....	.	1106
8.99	28.98	28.95	29.26	28.60	28.97	.	24 1/3	5 2/3	.	8	....	....	..	3.820	3 1/3	.	2 2/3	.	.	.	2/3	.	1 1/3	.	12 2/3	.	3	.	3 2/3	.	2 1/3	.	....	.	.....	....	.	1268
9.41	29.40	29.39	29.76	29.10	29.40	1/3	16 2/3	12 2/3	2/3	6	....	....	..	4.080	1/3	.	3	2/3	.	.	.	.	.	.	3	1 1/3	1/3	2/3	12	.	7	1 1/3	....	.	.....	....	.	1228
8.82	28.82	28.82	29.10	28.50	28.82	.	.	.	.	5	...	....	2	3.063	.	.	1/3	.	7	.	1 2/3	.	2/3	.	8 1/3	.	7	.	5	.	.	.	....	.	.....	....	.	1100
8.77	28.77	28.78	29.13	28.46	28.77	2/3	12 2/3	16 2/3	2/3	12	....	....	3	5.098	2	.	.	.	1 2/3	.	1/3	1/3	5 1/3	1/3	3 1/3	1/3	3 1/3	1/3	8	.	3	1 2/3	....	.	.....	....	.	1112
8.39	29.38	29.36	29.74	29.03	29.38	.	16 1/3	13 2/3	.	6	....	....	1	5.790	1/3	1	1 1/3	.	.	.	1/3	1 1/3	3 2/3	1/3	1 2/3	2/3	7 1/3	1	3	1	7	.	....	.	.....	....	.	1178

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